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The Golden Age of Gas.

IT seems scarcely possible that the city fathers are serious in their proposition to return to lighting the streets with gas. One might understand it if it were accompanied by other symptoms of an intention to return to Knickerbocker simplicity, but it is very doubtful if even a retrogression to the mediæval tallow dip could imbue them with the spirit of the honest burghers of New Amsterdam—to judge by the present price of subways! The bids made for electric lighting were by no means excessive, considering the character of the service, and it is hard to see what good can come from the present deadlock. The electric lighting companies cannot be expected to do the work for glory, and if the Gas Commission has the idea that the public will calmly submit to its scheme for "bearing" the price for street lighting, it is laboring under a delusion. The worm will turn, and a few weeks of feeble yellow gas lights will call forth protests of a kind that will not form a pleasant subject for contemplation.

The Westinghouse Electric Railway.

CONSIDERABLE interest is excited among electrical circles in the railway system that will soon be vigorously pushed by the Westinghouse Company. It is understood that the alternating current motor is to be used, and this alone is enough of a novelty to force the system into public notice. Just how well the alternating current motor will perform under the very severe conditions of street car service it is difficult to say, but it is certain that the subject has been carefully considered, and it is understood that the preliminary experiments have been encouraging. The real merits of an electric railway system can, however, only be determined after exhaustive trial in real service, and the performance of the first alternating motor road installed will be watched with the greatest interest. The new company starts with a powerful backing, and a determination to push, so that we may soon expect to see its system in actual operation.

A Loud Speaking Phonograph.

WE present in this issue illustrations of a modified phonograph, which, in some respects, produces very remarkable effects. Although the phonograph is not at all an electrical instrument, it is so intimately associated in the public mind with electricity, especially since the machines have been driven by electric motors, that we do not hesitate to give it a place in our columns. The present instrument differs from the usual form in having a multiplicity of non-metallic diaphragms connected with a single stylus by means of a spider. The small size of the individual diaphragms seems to make their vibrations more regular and freer from segmental vibration and overtones than would otherwise be the case, while the requisite volume of sound is obtained by the use of several diaphragms instead of one. The result obtained is certainly remarkable, for the voice is reproduced with hardly a trace of metallic overtones, and the volume of sound is sufficient to be heard distinctly many feet away. Additional smoothness of tone is obtained by using a non-metallic trumpet. Even without a trumpet the instrument, speaking directly off the face of the diaphragms, is distinctly audible over an ordinary room.

A Remarkable Vacuum Pump.

UP to the present it has been considered impossible to obtain a vacuum good enough for incandescent lamps except by the use of mercury pumps. The fundamental difficulty with all mechanical air pumps is that nearly the full pressure of the atmosphere is available to force the exterior air through the packing into the pump cylinder; so that very high vacuums are out of the question, for no system of packing can be relied upon to keep the moving parts tight against so great a difference of pressure. The Berrenburg pump, which we illustrate this week, avoids this difficulty by using a vacuum jacket around the main pump cylinder. Consequently, the difference of pressure tending to force air into this inner cylinder may be made vanishingly small, so that the final vacuum attainable practically depends only on the perfection of the fit between cylinder and piston and in the valves. There is no reason why a degree of exhaustion comparing favorably with that reached by the best mercury pumps cannot be obtained by this device, since, instead of combating full atmospheric pressure, it is only necessary to guard against leaks under a differential pressure that may be decreased indefinitely.

A Dynamo Worth Studying.

IN another column we give a description and cut of a dynamo that, by reason of its peculiarities of structure and enormous output in proportion to weight, is worthy of more than passing notice. It belongs to a type of machine to which considerable attention has lately been paid in a quiet way—the open coil disc machine. It possesses the merits of great simplicity and very small cost of manufacture, while its efficiency should be decidedly high. The many-spoked wheel that forms the armature is from its structure strong and light, while it is so thin that the resistance of the magnetic circuit may be made very small. Until the present, such machines have been undesirable on account of their low electromotive force; but although Polechko's present machine gives only 25 volts, it seems not at all impracticable to secure a hundred, which gives a good working voltage for ordinary uses. The great simplicity of such a machine and its immense weight-efficiency would be strong points in its favor. The output of the machine we describe is nearly 44 watts per kilogram of total weight, and the weight per horse power of output is but 38 lbs. These figures are more extraordinary than even the Reignier-Bary dynamo recently described in our columns. Unless the mechanical difficulties of construction should unexpectedly become formidable when a machine is designed for commercial voltages, it would seem that this type may prove a formidable competitor to those now generally used.

Lighting at Long Range.

IT is with much regret that we learn through our London correspondent of the difficulties that have beset the lighting of England's metropolis at long range. The great station that has been in operation the past year does not seem to have at all fulfilled the high expectations of its projectors. The plan of a gigantic central station, located in some region of very cheap and available power, and reaching out a colossal spider's web of mains to distribute light and power over an almost unlimited area is one that cannot fail to fascinate the imagination. Such a scheme brings with it a sense of the immense power that can be controlled and wielded for the advancement of modern civilization. But unhappily the results of experiment do not substantiate the dazzling visions of theory. Not that our theories of electrical distribution are wrong, but the problem of designing and arranging a great station so that it shall not only be excellent from an electrical standpoint, but shall yield an adequate return for the capital invested is very complicated. The cost of power in an electric lighting and power station is but a small part of the working expenses, and as the centre of distribution is withdrawn from the points of consumption, although the bare cost of motive power may be much lessened, the cost of mains, transforming devices and repairs is increased sometimes by an amount that is startling. A nice balance is required between these two factors, and in cases where the distance from dynamo to consumer is great, unknown quantities enter the problem to an extent that may upset the most elaborate calculations. There will be for any given place a distance beyond which it will not be economical to go for power, and this distance is determined not only by the perfection of the electrical system, but by the nature and extent of the distribution that is to be attempted. So, on the whole, there is little in the report from London to discourage the progress of the art of supplying electrical energy; the details of the partial failure there may be almost invaluable in supplying data for another and more successful attempt. The lesson of the Atlantic cable should not be forgotten.

Effect of Currents on the Human Body.

WE publish this week a rather sensational article that has attracted much attention abroad, and will probably awaken no little interest here. It appears to be a case in which really careful investigation was followed by hasty and somewhat illogical conclusions. The fact was clearly established that the resistance of the human body was greater for a continuous current than for an alternating current of the same nominal voltage. It was also shown that an alternating current produces sensations far more disagreeable than a continuous one of the same nominal strength. All this is interesting; but the conclusion drawn, that an alternating current is 34 times more dangerous to human life than a continuous current of the same voltage, is simply sensational, and without any logical basis in the facts. It must be remembered that the alternating current was furnished by an induction coil. Now it is altogether probable that in such case the maximum electromotive force is many times in excess of the nominal value. Hence, inasmuch as the apparent resistance of badly conducting material is known to decrease in a very striking manner as the electromotive force with which it is tested increases, a serious error is committed in comparing the resistance of the body to a continuous current with its resistance to an alternating current not of the same, but of much higher, voltage. It must be remembered that in a commercial alternator the maximum voltage is less than twice the nominal voltage, even in the extreme case when the electromotive force does not follow strictly a sine curve, but one with far sharper maxima. Although, therefore, in an alternator the maximum voltage available for breaking down insulation is greater than the nominal, this excess is far less than in the case of an induction coil, so that conclusions drawn from the latter case will not apply with any force to the former. For the same reason, the conclusions based on the sensations produced by direct and alternating currents are at fault. For if, as seems probable, the sensation depends somewhat upon the maximum voltage, the results obtained with an inductorium cannot fairly be compared with either those from the continuous current or that derived from an ordinary alternator. There is little doubt that an alternating current is distinctly more disagreeable, and produces a severer nervous shock, than a continuous current of equal nominal electromotive force, but by an amount that can only roughly be guessed at. Plenty of men can be found that have encountered a thousand volts of either kind of current and lived, but such accidents usually occur under circumstances that rob them of all scientific significance. A cleaner around the dynamos touches a wire, for example—he is thrown down senseless and recovers. No one knows just how it happened or to what voltage he was really exposed. His hands may be covered with oil so as to be practically insulated, and he may thus escape even if thrown across the terminals of the machine. All this does not prove that a current of the voltage involved cannot kill; it only shows that it did not have a fair chance at the subject. Inasmuch as death by electricity does not result from serious physical lesions, but from nerve paralysis due to shock, it will not express the truth to say that a certain current or a given voltage is dangerous, and experiments on the human body with the currents used in medicine are of little value. The strictly logical deduction from the experiments we have been discussing is that an induction coil is a good thing to keep away from; but any practical decision as to the relative dangers of the direct and alternating systems is quite unjustified by the facts obtained.

NEW BOOKS.

Electricity in Modern Life. G. W. de Tunzelmann. London, Walter Scott. 272 pp. 94 illustrations. $1.25.

No harder task, perhaps, could be imposed upon a scientific man than to write a popular *expose* of that particular branch of human knowledge with which he is most familiar. It is difficult for him to suppress abstruse technicalities, and to condense a great subject into small compass without rendering it hopelessly dry. But most of all it is difficult for him to realize the stumbling-blocks that beset the path of the unprofessional reader who approaches a technical subject from the scientific standpoint. On the whole, the book before us is a valuable and satisfactory one—clear and interesting, but in spite of these merits, failing, in the way suggested above, to lead the novice along the smoothest available road; he is rather dragged perforce over a path made rough by the petrified methods of the text-books. In the very first chapter of his book Mr. de Tunzelmann introduces the reader to what is the bugaboo of every electrical student—static electricity. Now, static electricity should not he neglected, but it is not to-day the most familiar manifestation of electricity, and its importance cannot be fully realized until the student comes to grasp its marvelously close relation to the dynamical part of the science. In the following chapters on magnetism, and force, work and power, the author is far happier in his treatment, and the ideas of dynamical units and the conservation of energy are neatly handled. It is hard to understand, however. why in the next chapter on sources of electricity the dynamo is so subordinated to the frictional machine. A simple dynamo, like the Polechko disc machine described in the present issue, is really far more easily explained to the beginner than an influence machine, or a battery with its complicated chemical changes. The magnetic field and electrical measurements are well discussed in the two following chapters, and then in Chapter VIII the student is given a very clear rudimentary account of the simpler forms of dynamo. Chapter IX. gives an interesting account of the earliest attempts at telegraphy, but for purposes other than historical its value may be judged from the fact that in a chapter of twenty-five pages, Morse, whose system is known and used almost exclusively throughout the civilized world, is passed over with a somewhat contemptuous notice of fifteen lines. The following three chapters on land telegraphic service, cables, and the telephone are much better, and are full of useful and interesting information. The contents of Chapter XIII., the telephone exchange system, is a subject which has been neglected in the text books, and it is pleasant to find a brief but effective description of it here. The storage battery next comes in for a share of attention, and then in Chapter XV. the general subject of electric lighting is taken up. This chapter, short though it is, is admirably done. It is interesting to note the points that are made on the subject of private installations, a matter much neglected on this side of the water. Of course, we have many private installations in factories and the like, but private plants for residences are singularly rare here. Chapter XVI. treats the electric motor too briefly, but thoroughly well. Here again the notice taken of telpherage and electric launches will treat many American readers to a few new ideas. Following is another short but excellent chapter on electro-metallurgy then in Chap. XVIII. a few notes on electricity in warfare. Two other brief chapters, treating respectively medical electricity and some of the miscellaneous applications, conclude the work. On the whole, the book, with some faults, is a distinctly meritorious one, and gives a clear scientific account of the subjects treated. Its faults are of omission and arrangement, rather than of method of treat ment, and the volume is truly refreshing reading after the atrociously inaccurate collections of printed matter that too often do duty as popular science.

Standard Tables for Incandescent Wiring.—Chas. M. Davis, pp. 130. Second edition, 75 cents.

The second edition of this neat little hand-book is now out, and, though in no wise pretentious, contains much useful information and a great many valuable hints, both on wiring and general station details. The necessity of having proper foundations, engine and boilers in a station is forcibly put, and nothing could be truer than the author's statement of the evils that follow miserly management. The use of cheap oil may cost a station hundreds of dollars in repairs, while an unskillful engineer may destroy the usefulness of the system in very short order. The volume is eminently practical, and cannot fail to give many important suggestions to the lineman.

A Motor Without Fields.

The accompanying drawing represents a decidedly novel form of motor recently devised by Mr. J. C. Henry, well-known as one of the early workers on electric street cars. Its peculiarities are evident, for it possesses neither field coils nor field magnets, the torque being obtained from the mutual attraction of three armatures.

In the drawing, the motor is represented as mounted on a car axle. The three armatures are mounted on a triangular frame, supported on the axle, and free to revolve thereon unless held by a clutch; the three armature pinions engage on a common gear wheel, which is keyed to the car axle. When the clutch, shown in Fig. 1, is tightened, the axle will revolve under the impulses of the three armatures. If the clutch is released the armature will simply roll around upon the axle.

Fig. 2 shows more clearly the arrangement of the armatures. It will be seen that they are centered at the three angles of the equilateral triangle, and their peripheries clear each other by the smallest possible space.

Each motor has its brushes set 60 degrees apart, in such a fashion as to produce poles at the points on the armature

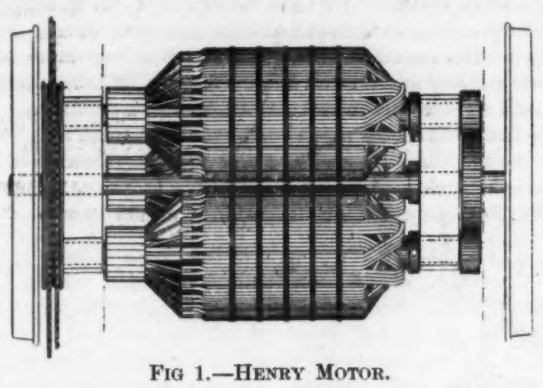


Fig 1.—Henry Motor.

nearest the two adjacent armatures. As will be seen from the figure, in the three armatures those poles are so arranged as to keep up a steady torque of magnitude depending upon the dimensions of the armatures and the currents passed. From the ventilation that can be secured a very high current density can be used.

It would seem as if the best results would be obtained by using a Pacinnotti ring armature with numerous teeth, as in that way the poles produced in each armature could be made quite intense, and the torque could be correspondingly increased.

The machine has been constructed to run in an experimental form, but no definite results have yet been obtained for its mechanical efficiency or output in relation to weight. It is an extraordinary motor, as being completely without field magnets, and it may be a useful subject for contemplation for those who are disposed to overlook the magnetic effect of the armature in dynamos and motors.

The arrangement of the brushes and the arrangement of the poles in the three armatures will readily be seen by reference to Fig. 2.

Electrical Engineering at Columbia College.

The building fitted up for accommodation of the new electrical department is now complete, and the school of electrical engineering seems to be supplied with every convenience and incentive to hard work and successful study.

The facilities for obtaining electric current of different kinds and in large quantities are particularly satisfactory. Continuous current to the amount of 100 ampères, under pressure of either 110 or 220 volts, may be had at numerous

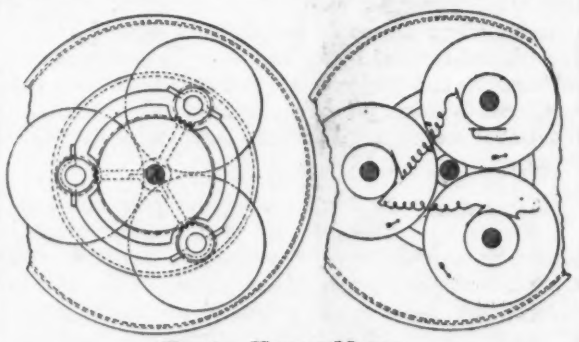


Fig 2.—Henry Motor.

points in all the rooms, from a specially installed circuit on the three-wire system connected with the Edison Thirty-ninth street station. Available at adjacent points, and parallel to this circuit, is another special circuit of equal capacity on the two-wire system, coming from the Edison dynamos of 400-light total capacity in the cellar. A third special current, also of 100 ampères capacity, has been put in to connect dynamos, motors, etc., in the electrical workshop down stairs, with measuring instruments in the upper laboratory, which is devoted to delicate work. A storage battery circuit, available at convenient points in the various rooms, is to supply current under an E. M. F. of a few volts for testing purposes, galvanometer work, electrolysis, and the many other duties that are performed generally in the laboratory by a number of separate primary batteries, with their attendant inconveniences. The buildings are lighted entirely by electricity from the regular circuits. Gas for heating and other purposes may be had wherever needed from pipes fitted around the walls of each room just below the ceiling.

The connection with the Edison central station is of great convenience, as current can be obtained and experiments carried on continuously without regard to the usual noon and evening stopping of machinery that is such a source of annoyance in this work. In one particular case a current was used with absolutely no interruption night or day for almost a week. The connection with the Manhattan Company's alternating circuit has lately been cut off by the city authorities, but alternating current and arc light dynamos are soon to be put in in order to avoid this unpleasant contingency. To avoid as much as possible any jarring, the tables for the support of instruments have no connection with the floor, but are fastened directly to the brick walls.

The course of instruction may be divided into branches, the practical and the theoretical. As so much of the progress that has been made in electrical science has been due to theoretical considerations, and as everything points to the fact that the electrical engineer of the future must be a theoretical as well as a practical man, the study of mathematical physics and the theory of electricity has been introduced as a necessary part.

The first session of the first year in the practical course is given up to the study of the fundamental principles of electricity, which deserve more attention than they generally receive.

In the theoretical branches of the subject are studied the theory of electric potential, electrostatic distribution and induction theory of the condenser, dielectric polarization, etc. The theory of electrical measurements starts with the principle of the conservation of energy, Joule's law, etc., and then passes to the construction, performance and use of electrical measuring apparatus of all descriptions. Transmission dynamometers and the methods of mechanical measurement are also treated. Co-ordinate with this theoretical instruction the entire afternoon of each day is spent in practical laboratory work in electrical measuring and testing.

In the second session the work is more advanced. On the practical side the construction and operation of dynamos and motors are studied carefully and minutely; also arc and incandescent lamps, telegraphs, telephones, primary and secondary batteries, etc.

In the mathematical theory the students take up the study of the laws governing the constant electric flow in linear conductors, theory of thermo-electricity, magnetism, electro-magnetic induction, Maxwell's dynamical theory of the electro-magnetic field, etc. The instruction in the theory of the dynamo and motor includes the characteristic and current curves of the different types of machines, construction and use of diagrams in practical work, determination of the different efficiencies, the theory of constant potential and constant current machines, etc.

The laboratory work carefully follows up this instruction and consists in the testing of dynamos, motors, batteries, etc., and also gives the students practice in the actual construction of simple electrical apparatus. Frequent visits are made to electrical factories, plants and stations.

The practical lectures of the second year are devoted to management of dynamos, motors, engines, etc., electric lighting plants and stations, electric power, the construction and use of submarine, quadruplex and other telegraphs, the extraction, deposition and purification of metals by electricity, and the theory of primary and secondary batteries. The mathematical course comprises the theory of varying currents and alternating current induction. The theory of the dynamo and motor covers the study of the alternating current dynamo and its characteristic, periodic currents, measurement of mutual and self-induction, methods of measurement of alternating currents, transformers, etc. In the laboratory and workshop, practice is given in the taking apart, putting together and repairing of dynamos, motors, and measuring instruments, and the construction of electrical apparatus such as winding armatures, etc.

Conferences are held one evening each week throughout the course to discuss current electrical literature.

The students have just finished the construction, for experimental purposes in the laboratory, of a battery of 1,280 cells, which when set up with Daniell elements gives an E. M. F. of about 1,400 volts, and when set up as a storage battery an E. M. F. of about 2,800 volts. Some interesting results have been obtained from the experiments performed with this battery.

There has just been erected in the mechanical engineering department a hydraulic testing machine of 150,000 pounds capacity, and it is now to be used by the electrical engineering students for a series of tests, which it is expected may be of considerable theoretical and practical interest in electrical science.

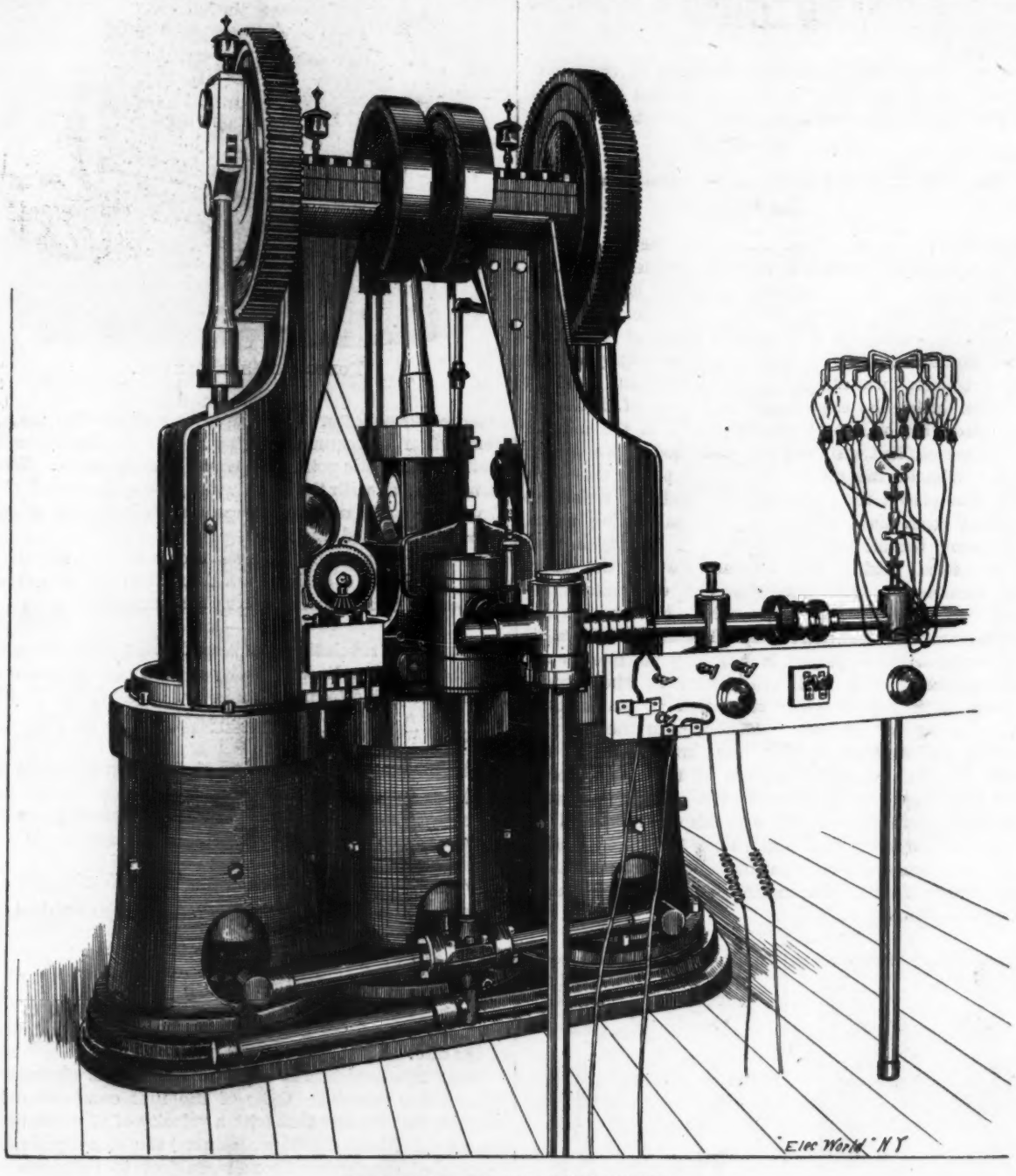
A New Electric Railway Company.

It is now definitely settled that the Westinghouse Company will go into the electric railway business on a large scale. The Westinghouse Electric Railway Company has been duly organized, with a capital of $2,500,000. Its home office will be at Pittsburgh, with branch offices in other commercial centres. Messsrs. H. McL. Harding, and J. C. Barclay, formerly prominently identified with the Sprague Electric Railway and Motor Company, at Chicago, and Mr. C. C. Warren, of the same city, have joined the new organization, and other men well known in electric railway circles have also been secured. The new company will push its business forcibly and immediately, as it believes there is more money in the railway business than in any other branch of the electrical industry at present. The details of its system have not been made public, but it is understood that it will use the Tesla motor in connection with the various appliances which the Westinghouse

Company has from time to time patented or purchased. They have now, it is claimed, the material for a complete system, and consequently they will take the field at once. The progress of the new organization will be watched with great interest, for it is to be expected that the Westinghouse Company will push the business with its accustomed energy, and the field is so wide that it will have ample opportunity. An alternating current electric road will be something of a novelty, and the results of the experiments that have been tried in private for some time past may soon be expected in practical shape. At one time it was thought that a car factory would be one of the adjuncts of the new company, but for the present, at least, it will furnish only the electric plants.

Quick Exhaustion of Incandescent Lamps.

In the commercial manufacture of incandescent lamps, one of the points most necessary to secure uniformity and excellence of product is the perfection of the vacuum obtained within the bulb. If the vacuum is not sufficiently good the life of the lamp is very much shortened, and unless a uniform vacuum can be obtained there can be no certainty about the durability of the finished product.



BERRENBERG VACUUM PUMP.

Of course it is well known that an incandescent lamp must be carried to a high degree of exhaustion before the current can be turned on and the process of flashing begun. This exhaustion is usually by means of mercury pumps, which work rather slowly but very effectively, securing a fine vacuum, but at considerable cost, owing to the expense of the apparatus and the time required to do the work.

Until the present time mechanical air pumps have utterly failed in the task of exhausting incandescent lamps. The reason for this is two-fold. In the first place, it is a matter of extreme difficulty to construct an ordinary air pump so as to secure a good enough vacuum for the work required. In the second place, if a pump can be made to obtain the requisite vacuum, it cannot be relied upon to maintain this state of excellence for any length of time. To any one familiar with the mechanism of an air pump the reason for this is quite clear. It is not a difficult matter to secure a fit of the valve good enough to avoid leakage, but the piston of the pump cylinder and the stuffing box above it cannot be secured against leakage except by extraordinary and continuous precautions. The cause of this leakage is the great difference in pressure which exists between the air outside the cylinder and the more or less complete vacuum within when the exhaustion reaches anywhere near the point necessary for incandescent lamp work, and the full atmospheric pressure is available to force air through every possible channel into the pump cylinder and through the valves. The extent of this leakage will depend in a great measure upon the difference in pressure pertaining to produce it.

There has been recently exhibited in Boston a mechanical air pump embodying some very novel features, and by which it is possible to obtain rapidly and easily a vacuum comparable with that obtained with the best mercury pumps. Some of the tests have been already published, but the facts seem to be these. The new pump will exhaust incandescent lamps quite as perfectly as the mercury pumps now in use, and it will do it in the space of a very few minutes. Of course the rapidity of the work is due to the large size of the pump cylinder, for the larger the cylinder—everything being equal—the more rapid will be the exhaustion. The perfection of the work depends upon the radical departure from the mechanism of the old air pump. This departure is simple in principle, and the reason for its effectiveness is plain enough. The device is adopted of forming a vacuum jacket around the working cylinder, so that whatever leaks in around the outer side of the box (which is closed with oil as in ordinary air pumps), is promptly pumped out by the subsidiary cylinders. The difference of pressure, therefore, tending to cause leaks in the joints and valves of the working cylinder can be reduced to a quantity almost negligible and the leakage almost disappears. This method, it will be seen, is a scientific way of reducing the difficulties which have previously made the mechanical air pump unavailable for the particular work for which this new pump was designed. Of course if it were necessary, more than one vacuum jacket could be used. The limit of exhaustion obtained is only limited by the perfection of workmanship in the working cylinder, and there is no reason why a vacuum cannot be thus obtained quite as good as has been obtained by mercury pumps.

We present herewith a cut of the new pump in question. By its use, working at a moderate speed, it has been possible to exhaust a large bank of lamps quite thoroughly enough in less than five minutes, and a group of thirty-six lamps has been exhausted and the current turned on without injury to the carbons, in 23 seconds from the time the pump was started. The time required by the ordinary mercury pump would be many minutes.

Just how perfect a vacuum can be obtained we are at present unable to state, but it is possible to so far remove the air from a lamp bulb, that on allowing mercury to flow into it, the bubble of air remaining will be barely one-sixteenth of an inch in diameter. This means a very high exhaustion, really better than is necessary.

In the pump shown, the middle cylinder is the jacketed working cylinder. The two outer cylinders serve at the same time to aid in the exhaustion and to keep the central cylinder in a pretty complete vacuum. Of course, if more rapid work or more perfect exhaustion were necessary, other cylinders might be added with excellent effect.

The published accounts of the various tests are by this time, through the daily press and the electrical papers, pretty well known. It is quite certain that the pump does the work, and does it well, and the method by which the result is obtained is as interesting from a scientific point of view, as the result from a commercial standpoint. The details of the pump are less important than the principle involved. The valves, however, like the valves in the best ordinary air pumps, are operated by a positive mechanical motion not depending upon the pressure of air, and the pistons and joints are packed with a refined oil, the exact nature of which is at present kept secret, although it is not a matter of vital importance, the success of the pump depending not upon the method of packing used, but on the principle of the vacuum jacket. It goes without saying that a mechanical pump of this kind can be made to work with almost any degree of rapidity, and a very large number of lamps can be exhausted simultaneously and rapidly by an increase in size or number of the cylinders.

The pump is the result of several years' experimenting on the part of Mr. Berrenberg, of Somerville, Mass., and it is only very recently that the machine has been perfected, as it was found difficult to get castings and workmanship good enough to reinforce the scientific principle on which the machine is based.

New England Electric Exchange Annual Meeting.

In the parlors of the New England Electric Exchange, 7 Park street, a score or more members recently assembled to participate in the exercises of the second annual meeting of the association. President P. H. Alexander traced the growth of the Exchange from its inception, and the work it had accomplished in the field of electricity. That the insurance underwriters entertain the idea of discontinuing inspections of electric light plants tells how much good the Exchange has done. The insurance companies say: "Obtain a license from the New England Electric Exchange, and we feel certain that no further inspection is needed from us." The president urged upon the members the necessity of continuing a policy of progression. The report of the treasurer gave the receipts of the year as $851, expenditures $667, and the cash on hand $183. By the license statement it appeared that there had been 354 applications for license, all of which had been granted after due examination. Officers for the ensuing year were elected. President, Alexander P. Wright; secretary and treasurer, H. H. Fairbanks, of Worcester.

A number of representatives of the New England Insurance Exchange were called upon to give their views on certain questions in which both organizations are interested. Mr. S. E. Barton said that the insurance companies were disposed to abolish the custom of making inspections on their own behalf where stations were established and managed under the direction of the New England Electric Exchange. Mr. E. C. North said that if the insurance companies felt sure that every piece of wire entering a building was properly insulated and the work thoroughly done, the risk from fire in this connection would not be as great as that from kerosene. Capt. William Brophy, electric inspector of the New England Insurance Exchange, said his duties were continually growing less onerous owing to the Electric Exchange. There was less danger to be feared from electricity in causing fires than from any other form of illumination. Secretary H. B. Crim, of the Electric Exchange, wanted to know, providing the Insurance Exchange abolished its system of inspections, where the Electric Exchange would obtain authority for enforcing its rules. He looked to the Legislature if an emergency of this nature arises.

See the Dictionary.

Little Boy (wrestling with a lesson on electricity)—Papa what's a volt?

Papa (stumped)—Um—look in the dictionary.

Little Boy (hunting it up and reading)—Volt—The unit of electromotive force, one ampère of current through one ohm of resistance. What's an ampère, papa?

Papa (with emotion)—Look in the dictionary.

Little Boy (after a moment)—Ampère—The unit of strength of the current per second. Its value is the quantity of fluid which flows per second through one ohm of resistance when impelled by one volt. Papa, what's ohm mean?

Papa (wildly)—Look in the dictionary.

Little Boy (after a search)—Ohm—The unit of resistance represented by the resistance through which one ampère of current will flow at a pressure of one volt. Papa what——

Papa (desperately)—Look in the dictionary. When you want to know anything always look in the dictionary, and then you'll remember it.—*Texas Siftings.*

The Management of Accumulators II.

BY J. K. PUMPELLY.

In the first paper on this subject the point was reached where, having made a set of batteries, we were putting them through a process of forming. Suppose, now, according to the chemical calculations before mentioned, the plates have a surface and atomic capacity of 100 ampères; practice has shown that a current of one-tenth the full capacity, or about five ampères to the square foot of surface, is the safest to use in charging a cell. The dynamo is regulated, either in its make or by introducing between the dynamo and the battery a resistance coil, to deliver through the battery ten ampères of current. If this is continued for ten hours, it can be estimated that each cell has received a charge that is supposed to be sufficient to make such chemical changes in the plates, that (in the reversal of chemical action that takes place in the discharge) energy to do the work of 100 ampères, or nearly this, is the result.

Practically there is a loss of 14 per cent. of energy by this conversion. This means that with an electromotive force or pressure of two volts, which is that of one storage battery cell in discharging, one ampère of current can be forced through a small lamp, to light it, or may revolve the armature of a motor, for 100 consecutive hours. We now have an idea of the size of the ampère current advisable for charging an accumulater of 100 hours' capacity. And it must be understood that this same current, continued 10 hours, produces the same chemical change in all the cells, however many there may be; but when the electromotive force is to be calculated as necessary, it is only necessary that there be enough—a surplus does not concern us; but there must be a pressure in volts of $2\frac{5}{10}$ to each cell, hence 30 cells would demand an electromotive force of 75 volts. A thousand more volts than this would do no harm nor any good.

If the calculation as to the capacity of the cell or battery —for an estimate of one cell is an estimate for all—in the circuit is eight, then, when 10 hours have been consumed in delivering from the dynamo 10 ampères per hour of current, there will be signs of disturbance on the surface of the battery, and the fluid or electrolyte will look as though boiling and become milky; this is generally a sign that the battery is charged. To explain this appearance, it is supposed that all the surface of the positive plates or electrodes have absorbed or in some way taken to themselves as much oxygen as they will receive, which oxygen has come from the decomposition of water; and the surface or exposed atoms of the negative electrodes have absorbed all the hydrogen they will; then, if the current from the dynamo is continued and the water is still being decomposed, both the oxygen and the hydrogen will come to the surface (hydrogen in quantities at the negative pole and oxygen at the positive) and thus produce a bubbling action.

If, however, a battery is badly made or the plates are poor and non-absorbent, this bubbling will appear in a short time. Such a defective cell should be removed from the circuit. When a battery is partly formed, as often happens, or has been charged and discharged a few times only, small bubbles of hydrogen gas come to the surface at the negative pole all the time, but when a discharged battery is well formed and the plates are of a dark color, especially the positive plate, this bubbling at the negative pole does not take place for a long time—in fact not until it is nearly charged.

We have now charged our battery 10 hours with a current of 10 ampères and with 30 cells in circuit, and used an electro-motor force of 75 volts. We may expect to get out of these cells nearly 100 ampères; but this success will depend very much upon the economical way in which the battery is discharged. We have in our 30 cells a pressure in volts of 30 multiplied by two, and for convenience we discharge through a 60-volt incandescent lamp which needs a current of one ampère per lamp and an electro-motor force of 60 volts, to produce a light of 16 candle power; hence, we could expect to light this one lamp 100 hours, or we might burn five lamps 20 hours, but if we discharged the battery through 20 lamps, *i. e.*, with a current of 10 ampères more than was used in charging it, we would probably notice a short time before the full five hours of burning had been completed a drop in the candle power, showing a loss of electro-motor force.

This may be because the chemical change produced in charging with ten ampères cannot be reversed in the discharge so much more rapidly, and still produce all the chemical action needed to get the full work out of it; probably the reversing of the oxidizing and hydrogen absorbing process does not take place as rapidly, there not being the same force or push behind it in the discharge as in the charging. We say *probably*, because it is a very convenient word in explaining phenomena not understood; but the truth is, neither scientist nor chemist knows much about the action of a storage battery, and the writer confesses, perforce, to the same ignorance, and speaks of what he sees in the action of an accumulator, but guesses at the rest.

The question is naturally asked by those who purchase accumulators and wish to recharge them: "How is it determined when a battery is fully charged?" The answer must be: "There is no certain way of knowing; an approximate idea may be reached by noticing the boiling on the surface of the electrolyte as before mentioned; and by the acidometer it is found that the electrolyte increases in density as the cell is charged." If it shows by the reading of the acidometer, which is left to float in the electrolyte, that its specific gravity has increased from 1,150 deg., its density when first poured in, to 1,210 or 1,220 toward the end of the estimated number of hours of charging, then it may be taken for granted that charging has been continued as long as necessary. But as "in dry weather all signs fail," so is it in this far more uncertain element.

As we get work out of accumulators through a constant change and movement of atoms, no instrument can measure what is seemingly held in it. Everything is estimated in the following uncertain way. If the plates are of a certain size and weight, and of a certain number, and are all alike in nature, color and material, and properly put together, and are charged with a certain constant ampère current, sustained by a sufficient pressure in volts for a certain number of hours, *then* you may expect to get efficiency out of it equal to the efficiency put into it, minus 14 per cent., if you discharge it as carefully as you charged it. If, however, one cell in the circuit is not in the same favorable condition, a thing very likely to happen, and that cell remains in the circuit, then the result is not so satisfactory.

Our next section will treat more minutely of the practical, everyday handling of accumulators and their uses, and the forms of different styles of accumulators.

The Temperature Coefficient of Swan Lamps.*

BY F. UPPENBORN.

Few observations have been made up to the present time on the resistance of temperature and coefficients of incandescent lamps. The experiments presented herewith will possess, therefore, a certain interest. In order to obtain a means of measuring the resistance of lamps at very different temperatures, a bath of linseed oil was employed. The lamp to be tested was attached to a stirrer, which was kept in motion during the experiment in a vessel of Bohemian glass filled with oil, which was suspended in the midst of another vessel filled with oil, also provided with a stirrer. Having brought the oil to the boiling point, the whole affair was placed in a wooden box and the resistance measured from time to time as it was cooling down. A nitrogen thermometer immersed in the glass vessel permitted taking the temperature of the lamp with exactness. The establishment of contact between the lamp and the wire to the apparatus presented several difficulties. Inasmuch as tin melts at the temperature employed, it was only possible to use lamps furnished with platinum contacts. The contact of these with copper wire was assured by an electrolytic deposit of copper. The measurements presented some difficulties, for the resistance of the lamps was not constant. The cause of this phenomenon was the heating of the filaments by the current necessary to measure the resistance, although this was furnished by a single Leclanche cell and must have been very slight. This trouble was avoided by putting a very large resistance in the battery circuit. The results obtained are presented in the two following tables:

I.

Temperature of the lamps.	Resistance in ohms.	Temperature of the lamps.	Resistance in ohms.
300.0	51.003	175.0	54.982
273.0	51.826	137.5	56.174
245.0	52.688	22.5	59.492
209.0	53.834	20.0	59.560

II.

286.2	100.10	114.5	125.34
284.5	100.19	113.0	125.54
282.0	100.60	112.0	125.75
254.0	104.70	70.2	131.85
251.5	105.05	68.6	132.05
250.5	105 15	68.0	135.25
210.0	111 15	47.5	135.25
209.0	111.35	46.0	139.14
208.5	111.40	20.6	139.24
165.0	117.80	20.1	139.34
164.0	117.04	19.6	
163.0	114.40		

Putting out these observations on co-ordinate paper they were found to agree quite closely with the formula

$$y = a + bx.$$

The temperature coefficients, referred to the resistance at 20 degrees, are, for the first series of experiments, 0.000513, and for the second series of experiments, 0.001056. The two lamps measured seemed to be of English manufacture.

The Frankfort Exhibition.

It is announced that at the electrical exhibition to be held at Frankfort-on-Main in 1891, the prices per square meter for space to exhibitors will be as follows:

15 marks in covered buildings.
10 marks in uncovered buildings.
2 marks in open air.
(A mark equals the English shilling.)

Where any exhibitor occupies more than 20 square meters of space a discount of 20 per cent. will be made.

The exhibition will be divided into twenty classes, of which one will be devoted to publications, periodical or otherwise, relating to electricity. The president of the committee in charge is Leopold Sonnemann, and the secretary is Alexander Askenasy.

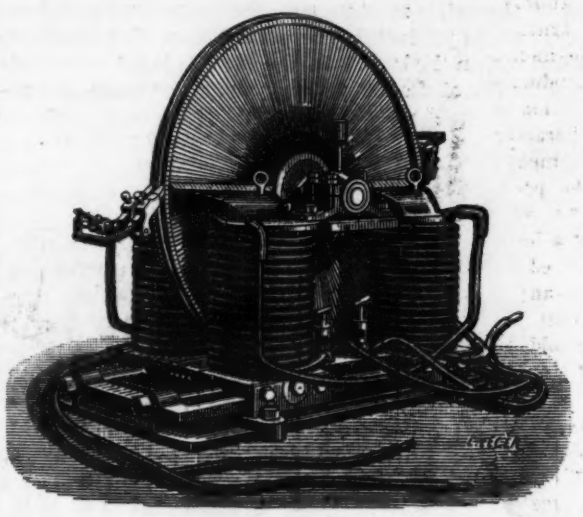
* *La Lumiere Electrique.*

A New Disc Dynamo.

The following details relative to Polechko's machine, says M. Besson in *La Lumiere Electrique*, were given by the inventor at the eighth Congress of Russian Naturalists.

The inventor's object appears to have been the creation of an industrial type of the Barlow wheel which should be simpler than those of Sir William Thomson and M Ferranti, though of similar class. Exteriorly it presents a disc formed of a kind of flat pulley in a single piece of great diameter, and very thin.

The disc forming part of the Polechko machine is made out of a single piece of metal, one metre in diameter; it is insulated from its axis and divided radially into 350 sections, separated from each other by some fibrous insulation to a distance of 13 centimetres from the axle. The periphery of the disc is bordered by a hoop of steel and insulated from the disc; it is wider at parts of the hoop so as



POLECHKO DISC DYNAMO.

to serve as a collector; the brushes are situated at the extremities of an equal diameter and of the diametrically contrary magnetic points of electro field magnets. With such a disc, as with that of Faraday, the amount of E. M. F. which may be usefully induced in the length of a diameter is calculated thus:

Let a represent in centimetres the radius of the disc, and a' that of the entire central portion, the length of the induced conductor in each radial magnetic field is:

$$l = a' - a;$$

the number of revolutions per second made by the machine being n, the mean linear velocity of each radial portion of the disc subjected to induction is

$$v = 2\pi \frac{a' + a}{2} n.$$

Let H represent the intensity of the magnetic field in C. G. S. units (number of lines of force).

The E. M. F. induced in each radial portion is expressed in volts by

$$e = \frac{n H v l}{10^8} = \frac{n H}{10^8} \pi (a' + a)(a' - a) = \frac{n H}{10^8} \pi (a'^2 - a^2).$$

This E induced in both effective radial portions is double:

$$E = \frac{2 n H v l}{10^8} = \frac{2 n H}{10^8} \pi (a'^2 - a^2).$$

Therefore

$$E = \frac{2 n H}{10^8} S$$

bearing in mind that $S = \pi (a'^2 - a^2)$ is the active surface of the disc.

Under these conditions with the dimensions shown by the machine (which are those of the first constructed by M. Polechko) we find that with a velocity of 27 revolutions per second (about 1,600 per minute) the disc dynamo is capable of developing 50 volts, subject to the magnetic field's intensity, H, equaling 12,600 C. G. S. units.

In many well known dynamos the magnetic intensity of the cores reaches 7,000 and 10,000 units; but in all machines alike the magnetic intensities of these cores become rarified in the *entrefer*, by reason of the development of the polar pieces, and the magnetic flow, properly speaking, is only two to three thousand units. This development of the polar pieces is not obligatory, and it is possible to have the intensity of the field in the *entrefer* not merely equal, but surpassing even that of the cores.

The intensity of the magnetic field is easily obtained by establishing it upon the data determined by Kapp and by Shelford Bidwell.

Thus we establish by means of the above calculation, that a rationally constructed disc dynamo is capable of furnishing an E. M. F. sufficient for all practical applications.

In the first machine constructed by M. Polechko, the magnetic intensity of the *entrefer* was only equivalent to that of the cores, viz., 6,500 units. This machine gave 25 volts and 2,000 ampères when running at 1,500 revolutions per minute; its weight was 1,140 kilos.

M. Polechko is engaged upon the construction of a new pattern of his machine that will be of almost similar dimensions, but will be furnished with a metal more suitable for the magnetic circuit. There is reason to hope that dynamos such as these, of solid construction, trifling weight and great simplicity will be found applicable in electrolysis, electro-metallurgy and even electric lighting.

The Micro-Graphophone.

An ingenious modification of the phonograph has recently been devised, that gives remarkable results in reproducing the human voice. The inventor is Lieut. Gianni Bettini, and he calls his improved apparatus a micro-graphophone. The object of the modification he has introduced into the existing phonograph was, to secure a reproduction of speech or music without the metallic tone sometimes so troublesome, and to secure a sufficient volume of sound to obviate the necessity of hearing-tubes.

To secure these ends he employs several independent non-metallic diaphragms instead of the one diaphragm of the usual instrument. These diaphragms are all operated from a single stylus, which is supported on a spider, one leg of which rests on the center of each of the diaphragms. Lieut. Bettini's theory with regard to this arrangement of diaphragms is, that when each individual plate is small it vibrates as a whole instead of being thrown into forced segmentary vibrations that change the quality of the tone produced. Of course, in any vibrating diaphragm set in motion from the centre the vibration is of a very complex character. If the diaphragm be large, the vibration in segments is likely to be considerable, whereas if it be small, the predominant vibration would be that of the whole; and, while overtones will undoubtedly exist, they will be of a less prominent character. In particular, anything like forced vibrations will be in a great measure avoided. In any large plate thrown into motion from a single point, that point might happen to be so chosen that it would fall at a vibration node of the plate, in which case it would fail to produce a proper motion of the whole.

This is Lieut. Bettini's theory, and the results he has obtained in practice are such as to render it exceedingly plausible. To secure a sufficient volume of sound while still using diaphragms of small size, several of them are, as we have said, connected by a spider, and act from a single stylus. The result appears to be that the effective vibrating surface is very much increased without a corresponding increase of the segmentary vibrations that produce a false tone color.

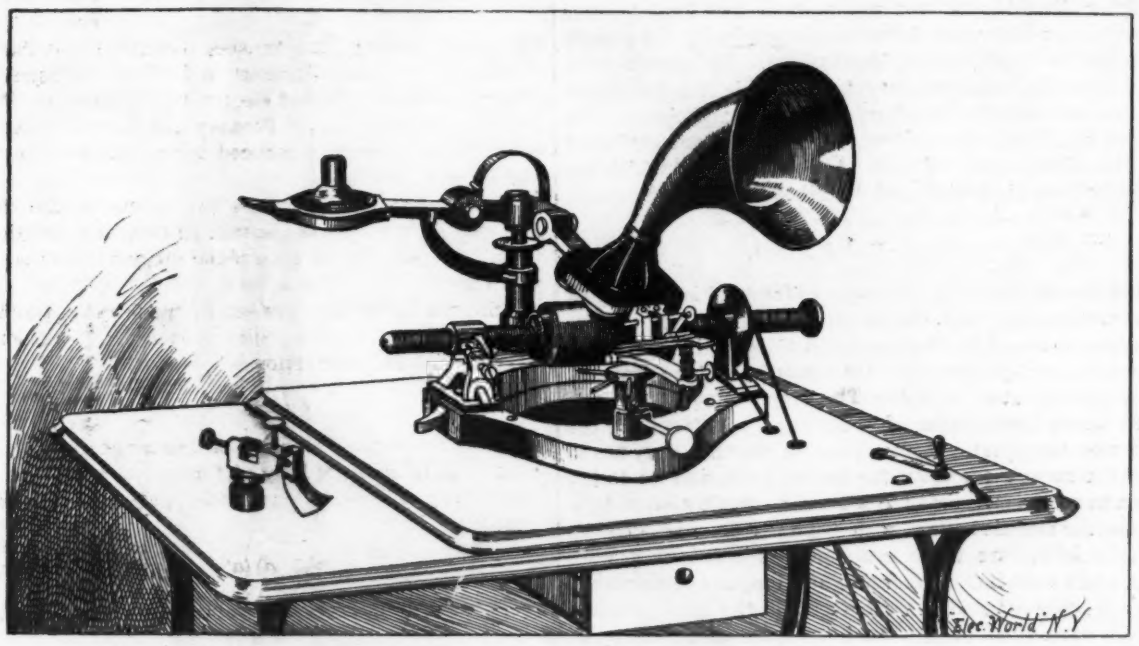


FIG. 1.—BETTINI'S MICRO-GRAPHOPHONE.

The arrangement of the instrument is, as will be seen from Fig. 1, very similar to that of the phonograph in ordinary use. The peculiarity exists in the arrangement of the diaphragms. These are non-metallic. In making the record in this machine, the single stylus receives the united impulses from all the diaphragms, and when this record is reproduced, all the diaphragms are correspondingly thrown into strong vibration. The result of this is that the micro-graphophone speaks with a volume of sound that is really remarkable. With a short and small trumpet it can be heard distinctly over a good sized hall, the articulation being clear and non-metallic in spite of its loudness. When the trumpet is entirely removed so that the sound comes simply from the face of the diaphragms, the tone is still clear, and distinctly audible over an ordinary room.

In Fig. 1 the quadruplex diaphragm is shown, each individual plate being of the same size.

In Fig. 2 the arrangement of the diaphragms is shown more in detail.

In Fig. 3 a different form of diaphragm is displayed, which has proved to give excellent results in practice. This last is an exemplification of the inventor's theory, that by using diaphragms of different sizes, responding most freely, therefore, to different notes, a better reproduction of the human voice can be obtained than with a single diaphragm. Whatever the number, however, the principle of the operation is the same. As the instrument increases in complexity, the legs of the spider are multiplied, and all are united to operate a single stylus.

It is hard to estimate the loudness of the sound, but the volume poured out by the four small diaphragms of this instrument is most amazing. They seem to work in perfect unison, and their tendency appears to be to reinforce rather than to deaden each other. The reproduction of the human voice is singularly clear and free from any harshness or metallic sound. By the use of a non-metallic trumpet the tones are still further softened. In reproducing music the notes of different pitch come out with singular distinctness, and the *timbre* of the voice is admirably preserved. It appears that by making the individual diaphragms small enough, so that the vibration

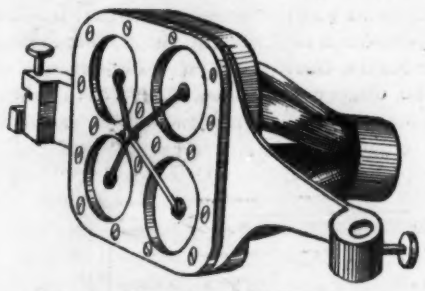


FIG. 2.—DETAIL OF DIAPHRAGM.

produced by the stylus is the vibration of the whole, unusual loudness and a remarkable degree of distinctness have both been secured. While making the record, a comparatively low tone of voice is reproduced with remarkable distinctness. Even a whisper is whispered back from the diaphragms very clearly.

Lieut. Bettini's instrument certainly gives a reproduction of speech or music that is singularly faithful to the original record, and its loudness is all that can be desired.

New Method of Bleaching.

The *Electrician's Gazette* of St. Petersburg describes the new system of bleaching intended by its inventor, M. Stepanoff, to replace that of M. Hermite, especially where, as in Russia, chloride of magnesium is rare and expensive.

M. Stepanoff, by means of a hydraulic pump, fills his apparatus with a solution of sea salt. In this the electrolysis takes place by the action of a current from a dynamo driven by steam or other power. The decomposition having taken place, a hydraulic pump returns the chlorinated solution into reservoirs in which the bleaching is effected.

The electrolytic apparatus is in a tank divided into 10 intercommunicating compartments, in which are placed electrodes of platinum and lead. The salt solution reaches the 10 compartments simultaneously. M. Stepanoff's model calls for a current of 40 ampères and 45 volts; its

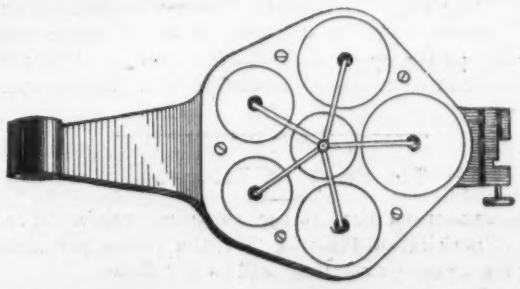


FIG. 3.—DIAPHRAGM OF BETTINI MICRO-GRAPHOPHONE.

dimensions are calculated on the basis of furnishing 300 litres of chlorinated solution per hour, or 62 hectolitres in 24 hours, equivalent to 37.5 kilograms of chloride of calcium.

The apparatus requires little care or attention, the operator having merely to empty and refill it from time to time.

Although the solution may contain as much as 1,6 per per cent. of chlorine, for economic reasons the inventor does not go beyond 0.7 per cent.; in Hermite's system 0.3 per cent. is never exceeded. Another advantage connected with the new method is the use of lead in place of zinc; for the latter is quickly consumed and becomes covered with impurities, requiring a special cleansing. Furthermore, by this change the amount of platinum required is reduced to one-third.

The Speed Indicator Erred.

A letter from Mr. Patrick B. Delany informs us that the reading of his speed indicator, used at the National Fast Telegraphers' Tournament, turned out to be erroneous in the instrument used. It had been put together only a few minutes before the trials began, and was not properly adjusted, so that on examining the results it was found that the impulses recorded on the speed indicator were considerably in excess of the actual number of impulses sent.

Mr. Delany further says that on adjnsting the instrument this difficulty was entirely overcome, and that it will now work at a speed of 13 pulses per second for hours at a time without a single error. This shows clearly enough that the erroneous result obtained was due simply to the lack of proper adjustment, and not to any fault inherent in the instrument.

Storage Batteries with Incandescent Plants.

The senior special agent of a well-known electric company says: "One of the features I meet with in endeavoring to sell an incandescent plant in a small town is the desire for the additional installation of a set of storage batteries, in order that the users of the light may have the current on tap during the entire twenty-four hours. At first I endeavored to drive all such ideas away, having been led to believe that no cell yet devised had proved a commercial success, and, moreover, having been taught that the success of the accumulator meant a loss of business to us. But the inquiries for a suitable battery increased to such an extent that I finally gave the matter a thorough investigation on my own account, finding, to my utter surprise, that several central stations had been using storage batteries successfully, economically and profitably for some two years, and that in each case the introduction of the battery had secured a sufficient number of additional customers for the light to warrant the purchase of a dynamo specially wound for charging cells. So I have learned to look upon the storage battery as an able lieutenant to the incandescent dynamo, and to put in a good word for it wherever I go. This, I find, aids me greatly in closing deals, for though the parties may not care to introduce the storage system at once, the fact that, when desired, they can have the current on tap at all hours and yet only run their steam plant during the evening, is of sufficient importance to induce them to sign the necessary contracts.

"I believe that the agents who are now laughing at the secondary battery will have a better cash account at the end of the year if they will look into this subject as closely as I did."

About Arc Lamps.

To the Editor of The Electrical World:

SIR: Will you please be kind enough to explain the difference in brilliancy and amount of light of an arc lamp on a circuit, say, of 75 volts and 20 ampères, and another lamp on a circuit of, say, 40 volts and 30 ampères? Will you please explain the modus operandi of figuring out such a problem?

2. I also see in your journal advertisements of automatic motors. Am I right in thinking a motor maintains its speed regardless of the work being done?

Indianapolis, Ind. G. C.

[1. Arc lamps are constructed to work on various amounts of current and at various voltages. Within reasonable limits of voltage the amount of light given by the two lamps will be nearly the same, provided they consume the same amount of energy. Electric energy is measured by the products of the volts and ampères. If the voltage required by a lamp is great, the arc will in general be long, and may be so long as to injure the brilliancy of the light. If, on the other hand, the arc is too short, the light becomes dull. The usual range of voltage employed is from 30 to 50 volts. Below 30 volts it is hard to obtain satisfactory results, and if 50 volts is much exceeded the arc is likely to be too long for brilliant burning.

Of the two lamps you mention, the first would probably burn with an arc too long for the best results; the second should give a very powerful light.

Aside from the relative brilliancy of the two, the distribution of light would be quite different. In general the short arc does not give so uniform a distribution of light as a long one.

2. A properly constructed modern motor either for arc or incandescent circuit will hold its speed quite closely, irrespective of the amount of work done. There are usually some variations produced by load, but frequently a very small variation and sometimes almost none at all.—[ED. E. W.]

Ships and Compasses.

British warships seem, says a correspondent, to be threatened by an internal danger that has perhaps caused some of the losses by wrecks and collisions from which the Royal navy has suffered during the last ten years. The compasses of all iron ships have to be very carefully adjusted to free them from the magnetic influence of the hull, but warships constructed as they now are, entirely of steel, are found of themselves to possess a permanent magnetism which is governed by the direction in which they lie during building. That is, a ship built in a direction directly

north and south with the bow to the north, will be found to be permanently magnetized, the forward end being a south pole, while the southern possesses northern polarity. Under some circumstances on long voyages this magnetism is apt to change slightly in direction, and then the previously adjusted compasses are thrown entirely wrong.

The Kirwan Station Indicator.

Our cuts show the mechanism of a recent invention of Mr. George W. Kirwan, of Wilkesbarre, Pa., by which the problem of announcing stations in railroad trains seems to be in a fair way toward solution. The Kirwan Electric Station Indicator Company, Scranton, Pa., inform us that they intend to push this machine into use throughout the country, being convinced that it is decidedly superior to any similar contrivance now on the market.

AN ELECTRIC STATION INDICATOR.

The mechanism of the Kirwan machine is such that by touching a button the conductor of the train can cause indicators in all the cars to display the name of the next station, and a bell, ringing while the change in station-name is taking place, calls the attention of every passenger to the exact location of the train. The special feature of the device is its certainty of action, an escapement wheel freed by the armature revolving at each connection, and continuing in motion until a complete revolution has been made, when a slot-check arrests it.

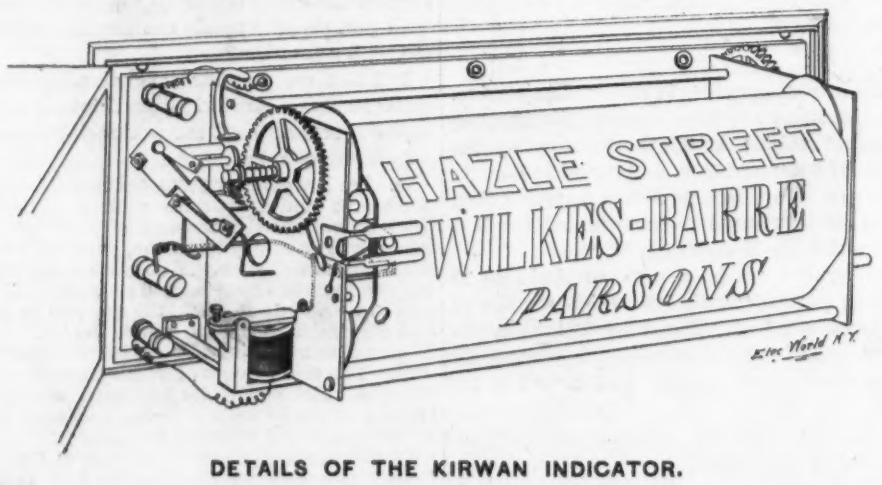
This annunciator has been used on the Buffalo and New York express of the Delaware, Lackawanna & Western Railroad, and it is expected to be generally adopted by that road and others as soon as its mechanism is made perfect. It is ornamental and inexpensive, and is certainly an admirable substitute for the present system of incomprehensible yelling by polyglot or a-glot brakemen.

Looking Backward Again.

On Friday, April 18th, at 5 o'clock, in the Lenox Lyceum, there gathered a large number of the representatives of the New York press to witness the first production of a farce entitled "Glimpses of the Twentieth Century." The scene represented was a bachelor's apartment in the city of New York. Through the broad doorway and out across the balcony could be seen the city with its 50-story buildings, and its score of North and East River bridges. Air ships of different sizes and construction were visible, shooting by on their way to Europe or Africa, as the case might be. Two gentlemen enter, busily engaged in a conversation, from which the spectator gathers the fact that Jack Whetmore (a bachelor of the nineteenth century) has just awakened from a trance, under the influence of which he has calmly been resting for over 100 years.

His astonishment at all the strange sights and appliances grows almost pathetic at times; for instance, when he is informed that, although each apartment is supplied with its own private tube for the conveyance of stimulants, people of that era never drink more than once in a given length of time. Newspapers are delivered by pneumatic tube, which is made quite an easy matter, considering that in that day newspapers do not contain either advertisements or fakes of any kind—nothing but the most necessary news in a condensed form. Light and heat, of course, are furnished by electricity; book agents and beggars are killed and disposed of by the character-register at the door of each building; phonograph clocks announce the hour, and music is furnished by the telephone, which also enables one to see whatever he wishes. And so it goes. Suddenly a peculiarly constructed air yacht darts by, and the astonished nineteenth century man is informed that it is the base-ball ship on its way to the great game that has lasted for two weeks without a single run. The loud-speaking telephone announces the election of the tenth president of England and the discovery of the North Pole. The astonished young man, overwhelmed by so many extraordinary sights and sounds, rushes frantically out, and the curtain falls on a very clever little farce.

After listening to the phonograph and long-distance telephone, which were shown to advantage by the experts detailed to handle these instruments, the guests were invited to the manager's private office, where a handsome lunch was served, including beverages and cigars, after which the Hungarian orchestra played an accompaniment to the illumination of the "tower of light," which has already been illustrated and described in these columns.



DETAILS OF THE KIRWAN INDICATOR.

A Large Hotel Plant.

The Tampa Bay Hotel Company, Tampa, Fla., have just closed a contract with the Eureka Electric Company for the installation of 2,000 incandescent lights in the hotel, and whatever arc lights may be required about the grounds, the current for the arc lights to be supplied from the same low-tension Loomis dynamos that supply current for the incandescent lights. Under the same contract they are to wire the house throughout for electric bells, and to do the work in such a manner as to allow the substitution of telephones for electric bells at such time as may be desired.

A special feature to be introduced in connection with this plant is an incandescent night-lamp, one being placed in each bedroom, and so arranged that the occupant can keep it burning all night at such a degree of brilliancy as may be desired, making it more convenient than gas, and especially desirable in case of sickness, where pure air is of such importance.

Situated in a separate building, 400 feet from the hotel, will be placed the boilers with capacity of 250 h. p.; two automatic high-speed engines of 110 h. p. each, and four dynamos of 500 lights each, making a central station with a capacity of 2,000 lights.

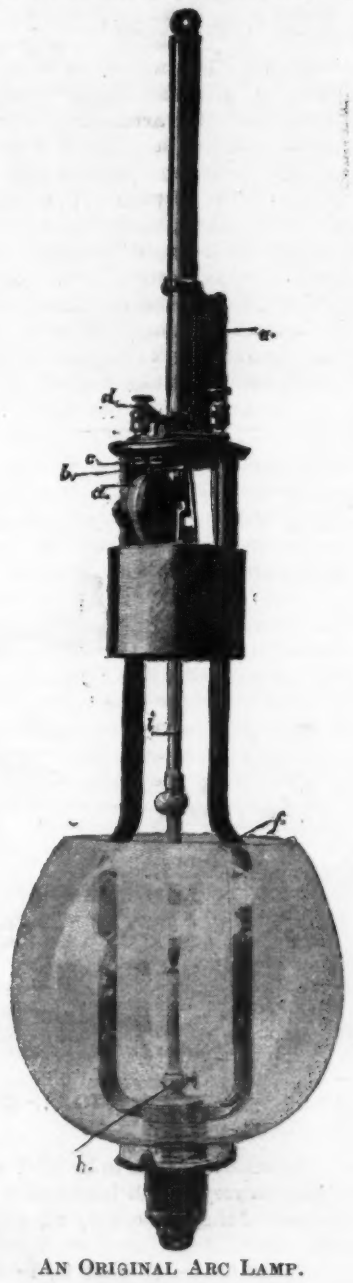
A feature of the installation is to be the switchboard, which is designed to control all the lights, both arc and incandescent. It is of special design, and is so constructed that the dynamos can be run singly, in pairs, or in multiple; in fact, any desired combination of dynamos or circuits may be made in a few seconds. There will be four main circuits running from the dynamo building to the hotel, which are to be laid in an underground conduit. An ammeter and ground detector will be attached to each main circuit, and a voltmeter so arranged with compound switch, that the E. M. F. of any or all dynamos can quickly be taken.

The Nutting Arc Lamp.

This arc lamp is operated by the heat developed in a portion of a high resistance shunt around the arc, which produces a continuous movement of the upper carbon corresponding exactly with the burning away.

Its great merit is in maintaining the proper length of arc within a wide range of variations of current and without readjustment; and it automatically cuts itself out when the carbons are burned out, as well as when the carbon rod is hung up from any cause. It will work on any constant current circuit of from five to ten ampères or on a constant potential circuit with incandescent lamps in parallel by maintaining a difference of potential of 45 volts between its binding posts, in either case producing a very steady and noiseless light, unaffected by any ordinary variations in temperature. The lamp has been tested in out-door variations of 80 degrees Fahr. without readjustment or material variation in either the length of arc or the character of light.

There is no current in the frame. Strength is obtained with a weight of less than ten pounds; the length over all is 46 inches; frame at widest place six inches; cover, including working parts, 4 × 4 × 4 inches.



An Original Arc Lamp.

The drawing represents the lamp complete, and shows the cover drawn down exposing the working parts to view, *a* being a wheel of a substance like stearine, that melts at a temperature of about 140 degrees Fahr. Fitted to rotate by the weight of the carbon-holding rod *b* is a copper pin (held stationary in the part *c*) that projects down the top of the wheel about ¼ inch. The upper portion of the pin is wound with several layers of fine insulated resistance wire, which forms part of the shunt around the arc. This copper pin is heated more or less according to the amount of current passing through the wire surrounding it, and melts a way for itself through the substance of the wheel, allowing it to turn. The substance while liquid flows around the pin and hardens in its original position behind it, and is ready for the operation to be repeated as the wheel revolves.

The box *e* contains the balance of the shunt resistance, and is provided with a thumb screw, by which the amount of resistance can be varied and the arc adjusted to the proper length; *d* is a hand cut-out.

When placed on an alternating circuit the operation is admirable. An automatic regulator has been applied to some of the lamps, adjusting the shunt resistance at *e* in accordance with the temperature. When the arc starts, it requires only a few minutes to establish steady temperature conditions, so that the lamp will settle down to its regular rate of burning. The action of the lamp is very smooth and regular, and as it does not depend on magnets, it is equally successful on direct and alternating circuits.

A New Motor and Fan.

We show herewith a cut of a combination motor and fan recently brought out by the Wing Fan Company. The fan is of their well-known form, having, however, a wider case than is usual, as the frame is extended sufficiently to allow of the motor being placed completely inside it. The fans are manufactured in sizes from 24 to 48 inches in diameter, and the motors contained therein are from ¼ h. p. to 1½ h. p. The speed of the fan ranges from 600 in the smallest size to 400 in the largest. The motor employed is a special type of Riker motor, arranged to be fastened permanently to the fan case. The combination makes a very compact and powerful blower. The motors are found to give exceedingly little trouble, and the amount of power expended is decidedly small.

Fans of this sort are very convenient where current is available, for the volume of air displaced is great, and inasmuch as the fan is directly upon the armature spindle, the operation of the machine is almost completely noiseless. A good number of the fans are already in use, and the combination seems to be an exceedingly effective one.

A Novel Arc Dynamo.

We present herewith cuts of the new Excelsior arc dynamo. As will be seen, the machine embodies some rather striking features. The armature is a Pacinotti ring, made unusually deep in radius, and it is so thoroughly covered by the pole piece that there is very little of the so-called dead wire. The Pacinotti ring possesses great advantage when high potentials are to be used. Inasmuch as there is no great difference of potential between any contiguous wires, and each armature coil is firmly held in place, the deep form of the ring renders a very considerable amount of wire useful which would otherwise produce only harmful resistance. To cover as far as possible the whole active surface of the ring, the pole piece is made in the extraordinary form shown, the outer portion of it being hinged and able to be thrown back to permit the removal of the armature. The whole machine is constructed of a special grade of castings, no wrought iron, with the exception of the armature coil, being used.

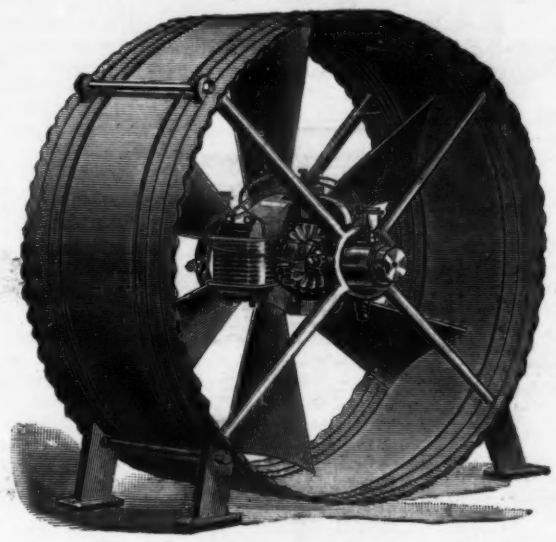
It might at first be feared that splitting the field in this way would produce a good deal of harmful magnetic resistance, but it is now pretty well known that a well-faced joint, if the surfaces are pressed together forcibly, as they can be by bolts through the lugs shown, offers comparatively little magnetic resistance—much less than used to be supposed. The method of regulation employed in this machine is essentially that of changing the current through the fields, in accordance with the demand for electromotive force on the external circuit. This is accomplished magnetically through the mechanism shown in the cuts. The machines now made are of three sizes, furnishing 75, 50 and 30 lights, respectively, the rates of speed of the different sizes being 820, 900 and 1,050. An efficiency of somewhat over eighty per cent. is claimed for the machine, and its regulation is reported to be excellent.

In Fig. 1, the machine is shown closed in its working form. As will be seen, the machine is a very compact one, strong mechanically, and having but two coils on its field. In Fig. 2 the pole pieces are shown thrown back, ready for the removal of the armature. Everything about the entrance swings back free and clear, and allows perfect access to the commutator and very ready handling of the armature. This is an important advantage, as the armature of a large arc machine is by no means light.

The arc dynamo with a ring armature of many segments is pushing its way into prominence, and deservedly; and the present machine, if reports be true, would be a valuable addition to the list of arc lighting dynamos.

Electricity vs. Mosquitoes.

The public-spirited citizens who have been endeavoring to find a sure cure for the mosquito evil have, it seems to us, attacked the matter from the wrong point of view. This is, indeed, now practically confessed by a concensus of expert opinion, which declares that, as a mosquito-



THE WING COMBINED MOTOR AND FAN.

eater, the dragon-fly is a failure. This voracious insect, unfortunately, shows his real character by eating, not mosquitoes only, but also, to a degree, the unfortunate youths of his own tribe that come in his way; so that the proposed dragon-fly farm, that was planned for the relief of New Jersey, would be in a measure self-destructive. Other considerations make it evident that the dragon-fly is not a sufficient antidote to the mosquito.

A correspondent in New Orleans writes us that this question has been considered there for many years; indeed, the dragon-fly is known in the South by the name of "mosquito-hawk," and is supposed to lessen the number of insects in the Louisiana swamps to a considerable extent.

"But," adds our correspondent, "it seems to me that the best way to rid cities of mosquitoes is to use the electric light. When arc lamps were first introduced in New Orleans the entire insect population of our neighboring swamps flocked to the city. Hundreds of thousands of them came in, and the regions beyond the radius of the lamps was cleared of its objectionable inhabitants, while the sidewalks and roads around each light were strewn, every morning, with dead and dying. Whether these included mosquitoes or not, I do not absolutely know; but the general impression here is that the city was more completely filled with the biting pests that year than ever before.

"Now, my idea is to reverse this operation. Half a mile beyond the outskirts of the city, in lonely, dismal swamps, let there be enormous clusters of electric lights. I am convinced that these would draw from the city a large proportion of the mosquitoes and all the larger flying insects. Arrangements might be made for collecting these after they had committed suicide, as they all do, by flying at the lamps, and it is probable that they could be sold as fertilizer for a sum large enough to pay the cost of maintaining the lights."

Our correspondent's idea is certainly novel, and if any city is so situated as to be able to put it into execution we suggest that the experiment be made; although we have decided doubts as to the lights being self-sustaining, as he suggests.

Possibilities of the Phonograph.

A dozen years ago, when the first imperfect instrument grated out the melancholy tale of "Hickery, Dickery, Dock," for the edification of admiring throngs, the papers were full of glowing predictions of magnificent future applications. Then ensued a period of lethargy, when the phonograph was relegated to the top shelf of the laboratory closet, to be dusted at the annual or semi-annual house-cleaning, or, possibly, taken down for the temporary amusement of a class of students. Now, however, the time has come for the development of what was really one of the most intensely original inventions of modern times. The latest instrument, with its mechanical perfection and loud clear tone, has already found its way into practical use. Many offices have already discarded the stenographer, who insists on twisting about and making unintelligible the simplest sentences, and have very largely substituted this mechanical stenographer, that never makes mistakes, never gets on a tear and arrives at the office two hours late, never stops one in the middle of a well turned period to request repetition, and never asks for an increase of wages. But this single useful application is only the first of a revolutionary series that must eventually take from human hands and voices some of the complex attributes of modern civilization.

The suggestion of phonographic reporting is one that will probably before long take a definite and material shape. Reports of evidence, important interviews, meetings of societies and the like, could be phonographically taken with a certainty of exactness and a faithfulness to details that can never be expected from even the best shorthand writer. Just now the instrument is not sensitive to a volume of sound small enough to meet these requirements, but the recent improvements have made it more than probable that this difficulty will be overcome ere long.

The phonographic newspaper, too, may possibly fill an important role in the journalism of the future. Fancy an interview with Gladstone or Bismarck reproduced not only in the words, but with the very intonations of the great statesmen. And Bellamy's suggestion of phonographic libraries is by no means an impossibility, for even now many a weary man who is not in the mood for reading would be glad enough if he could slip a favorite novel into his phonograph and take his ease while the instrument read to him without ever an interrupting cough or sneeze.

But it is in combination with the manifold uses of elec-

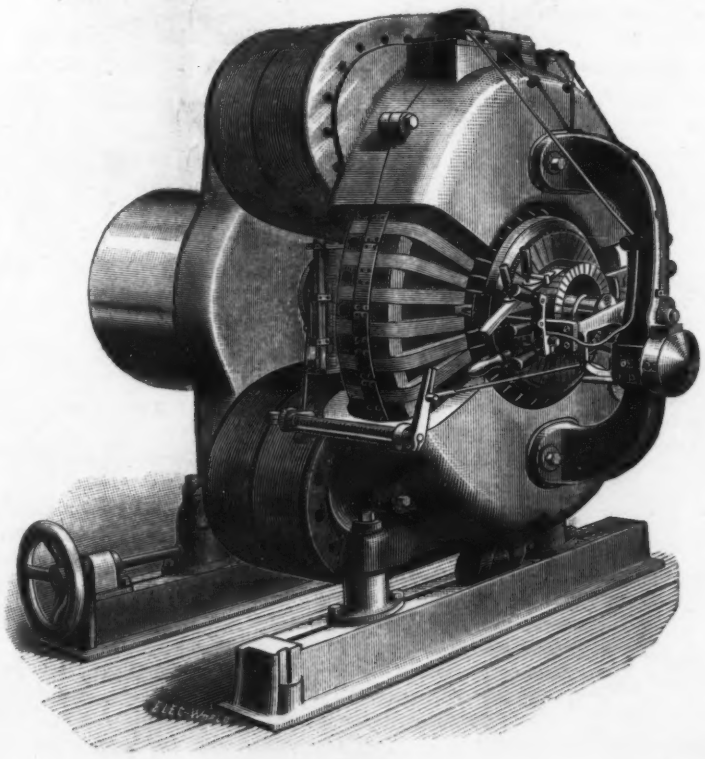


FIG. 1.

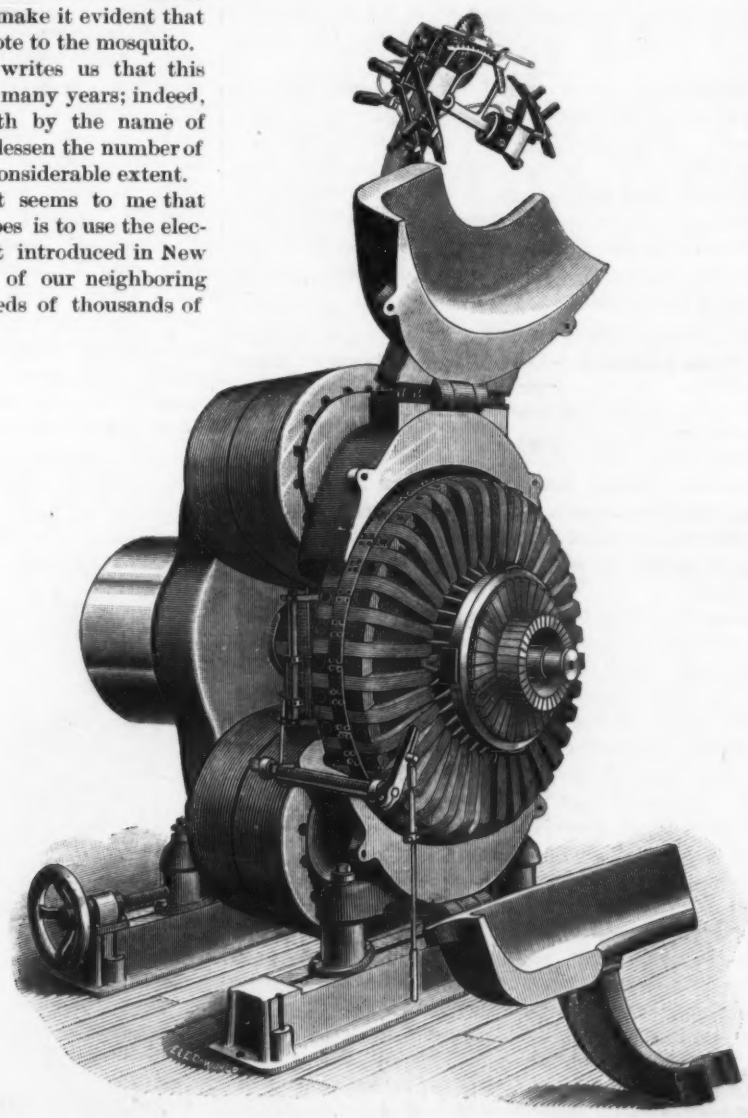


FIG. 2.

EXCELSIOR ARC DYNAMO.

tricity that are sure to come that the phonograph will find its widest and most useful application. Instead of annunciators, how much neater it would be if pressing a button could call out distinctly the number of the room in a hotel and what might be wanted. An electric door-opener could be so arranged as to welcome the incoming friend with a pleasant greeting while the same phonograph could vent objurgations on the itinerant book agent with a force and fluency that would make the second mate of a coal barge turn green with envy. On the entrance of a tramp the same push button could let loose the dog and urge him to the attack.

In offices a similar device would be universally useful—merely a mechanical bouncer to operate just ten seconds after the phonograph had informed the pestilent intruder that it was time to go. In fact, one of an inventive turn of mind could go on indefinitely devising valuable labor-saving devices. It must be that the phonograph will take a prominent place in our future environment, and it will be of great interest to watch the growth of the art, as one after another its possibilities are unfolded.

Municipal Ownership of Light Plants.

A series of articles have recently appeared in papers throughout the country, concerning the relative cost of of electric lighting when done by private parties and by municipalities. Several tables of startling figures have been put forth, the meaning of which seems to be on the face of their reading that cities can light themselves for about half what private companies will charge them for the same service.

It is our opinion that these figures are misleading, and that great variations in cost, such as they show, are due to local conditions rather than to the system of control. We know of cases in which a city's nominal payments for light have *not* included such items as superintendents' salaries, rents, construction, power, and even repairs; so that the cheap showing made at the end of the year was in reality, only too often, a delusion and a snare.

On the other hand, there is no doubt that jobbery often raises the figures of a city's contracts, in lighting as in other matters, but we are inclined to believe that this jobbery is no worse in its effect than the political wire-pullings that inevitably result from municipal control. A private company, at least, selects its superintendent on account of his ability, while a city would too often select him because he was "solid with the boys."

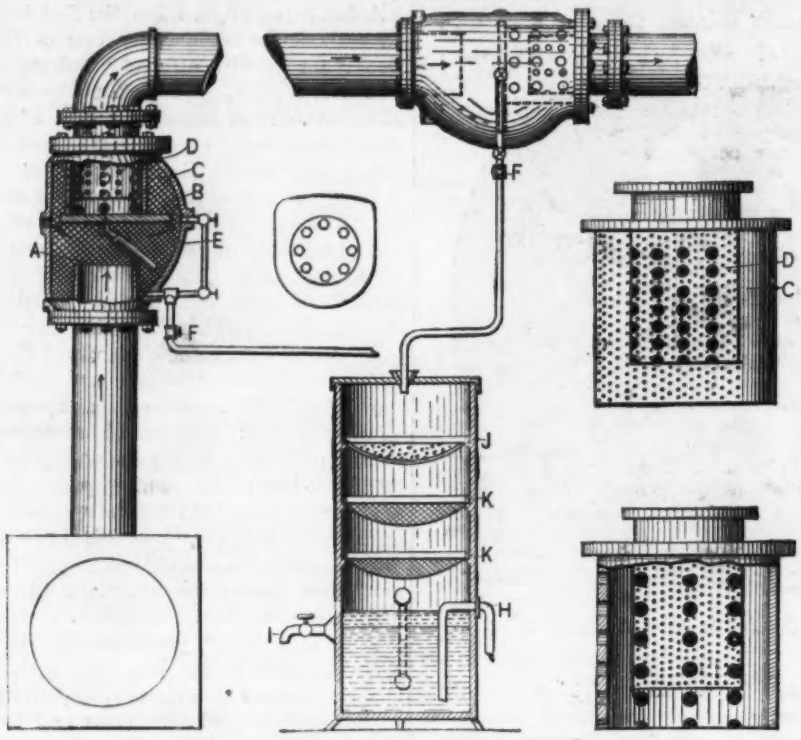
The question of private versus public control is one that crops up in many forms, and with increasing virulence; but the better plan in electrical matters will be to let individual effort do everything that it is not absolutely essential to have done by government.

An Exhaust Oil Extractor.

In the heating of mills, hotels and office buildings, as well as in many mechanical ways, such as the manufacturing of ice refrigerating machines, in dye houses, bleecheries, woolen and paper mills, breweries, etc., exhaust steam takes an important part, and by utilizing the condensation the fullest economy can be obtained. Probably one-half of the initial heat is retained in the exhaust on leaving the cylinder, and this exhaust when condensed is the very best for boiler purposes, all the impurities having been expelled. A serious obstacle, however, exists with many, preventing the adoption of this most important and economical system.

The oil fed into the cylinders and on the rods for lubricating purposes, being carried out with the exhaust, adheres to the inner surface of pipes, radiators and valves, at once reducing their radiating capacity and necessitating an increased pressure of steam. Where the condensation is returned to the boiler the oil is carried with it, working serious injury to the shell and tubes and entire system (in many cases requiring their removal), and causing the boiler to foam.

The Robertson extractor has been constructed to remove these obstacles. Unlike any other, it is adapted to either



ROBINSON OIL EXTRACTOR.

vertical or horizontal pipes, and in operation is simple and effective.

Steam on entering inlet *A* strikes plate *B* and is deflected against roughened sides of extractor, breaking it up and depositing a considerable quantity of oil and water, and then, partially cleansed, seeks an outlet through separators *C* and *D*, one within the other and both perforated to suit existing conditions, great care being taken to have the area of these perforations considerably greater than the inlet, and governed by the back pressure, under which the engine or pump may be working. These separators, presenting a broad, rough surface to the current of steam, again break it up and complete the separation of oil and water (which, in the horizontal drop to the bottom and in the vertical, are carried to side of extractor by small pipe *E*), the cleansed steam passing out through the outlet. The effectiveness of a device for this purpose consists in offering as many obstacles, and breaking up the steam as much as possible, without creating back pressure.

There is no possible chance of this extractor becoming sealed by an accumulation of oil and water in the pocket, and choking up the outlet, as both the sides and top of separators (about three-quarters their circumference) are perforated, affording ample means to escape.

Large area for expansion of steam is provided immediately on its entrance, and the roughened sides add fully three times the extracting ability of a smooth surface.

It is pretty generally acknowledged that lubricating and machinery oil loses but trifle of its lubricating qualities in passing through the cylinders, consequently that portion passing out with the exhaust, if recovered and passed through a filtering process, can be used over and over again, resulting in a great saving and soon returning the cost of the entire apparatus. The filter described, either in connection with the extracton or used separately, presents features of much merit while being exceedingly simple. The oil and water entering at the top pass first through a finely perforated tray (*J*) depositing all large sediment and then through two filtering cloths (*K K*) of different texture, completely cleansing it of every particle of grit and foreign matter. The siphon (*H*) carries off the water automatically, the oil being drawn off through cock (*I*) as often as the accumulation indicated in the gauge-glass may require. The lid and filtering tray, being loose, make it a very easy matter to clean.

Storage Battery Launches.

In spite of the rapid advances of electricity in America, there are still some directions in which the progress has been more rapid still in England. The storage battery, which on this side of the water has been rather slow of development, has for various reasons been utilized very extensively abroad. One use to which it has been put very successfully is the propulsion of small launches that otherwise would be driven by steam engines. The small steam engine is anything but a convenient thing to have in a boat, with its accompanying little boiler and tiny furnace. The accumulator, however, can be comfortably stowed away under the seats, while the necessary motor can almost be accommodated in the stern locker. The accumulators only require a few hours' charging for an ordinary pleasure trip, and are reported to give very little trouble. They are heavy, to be sure, but hardly more so than the engine which would otherwise be used and from the little room they take up give far more available space in a boat of the same size. A special type of compact and rather low speed motor is made for launch use, and in practice has proved efficient and durable. There are many cases in which such electric launches could be very conveniently used on our own inland waters, and electric lighting plants are getting common enough in small places to furnish a ready means of charging. Of course on the Thames lighting stations are common enough along the banks, so that even now quite a little fleet of electric launches are on the river. In this country, one or two such boats have been built, but they have not yet attracted much attention. From their many good qualities it is to be hoped that they will soon come into more extensive use.

The North East Railway.

The accompanying illustration gives a view of a curve on the North East Street Railway in Kansas City,

A VIEW IN KANSAS CITY.

Mo., which was built by the Thomson-Houston Electric Company, and has been in successful operation for more than a year. The line was first opened to the public on March 5, 1889, and has since grown steadily in favor and usefulness, so that the six cars now in use are shortly to receive reinforcements.

The line is 3¼ miles in length, and the overhead cross suspension construction is used throughout its entire length. There are 10 double-track curves of a minimum radius of 35 feet, and a number of grades with a maximum ascent of 8½ per cent. The electrical equipment of the road con-

sists of three 80 h. p. generators with suitable switchboard and applications. The operation of the road has been uniformly successful.

A Long-Distance Printing Telegraph.

For two or three years various reports have been made public concerning the Essick page printer, a form of printing telegraph adapted for use on long lines, and operated very much on the same plan as an ordinary typewriter. A regular line is now in operation between the New York and Boston offices of the company, and the apparatus has proved sufficiently effective and convenient to be worthy of more than passing notice.

We present herewith a cut of the instrument. As will be seen, the machine resembles a combination of typewriter and printing telegraph. The messages are received on a continuous roll of paper passing under the type wheel, in full view of the operator; and when the message is sent it is recorded both at the sending and receiving stations, so that any error can be at once detected and corrected. The full working details of the machine are not yet ready for publication, but the principle involved is a step-by-step movement of the type wheel secured by a polarized relay. The type wheel itself is very light and can be worked with great rapidity. It is possible to send and receive messages with an ordinary machine at the rate of 25 to 30 words per minute, while on the special machines 40 to 50 words per minute have been reached between New York

ESSICK PAGE PRINTING TELEGRAPH.

and Boston, over a line 270 miles long. The instrument has been operated over lines very much longer than the one over which this message was sent, 600 miles being accomplished without the use of a relay. The messages can be recorded in triplicate at the receiving station, as any reasonable number of instruments can be operated on the same line at the same speed. The sending mechanism consists of a series of keys like those of a typewriter, each key when depressed sending the proper number of impulses to turn the type wheel by the requisite amount. At the end of the line a key is pressed, and the carriage bearing the paper is slipped back and moved up a line just as in the case of an ordinary typewriter. Messages, therefore, are printed ready for delivery, and need only to be clipped off the continuous roll and sent. Some special interest has been aroused in this instrument by reason of its use being advocated before a congressional committee on the postal telegraph system. Of course, any printing telegraph possesses an advantage in the matter of accuracy of work, for mistakes are easily seen and rectified, while in ordinary Morse sending, a reproduction of the message is almost the only certain method of securing accuracy. The difficulty heretofore has been to secure a printing machine to operate rapidly over a long line. The performance of the present instrument, however, is satisfactory with respect to speed, and the work done is certainly creditable. One advantage of its use is found in the fact that it is a very simple matter to learn to operate the system, since one skilled in the use of the typewriter could manipulate it successfully with very little practice, instead of requiring a long telegraphic training.

Although the instrument has been noticed from time to time in the course of its development, the present stage of its progress is such as to warrant a considerable interest in what certainly seems to be a very practicable system,

Alternating v. Continuous Currents in Relation to the Human Body.*

BY H. NEWMAN LAWRENCE, MEMBER, AND ARTHUR HARRIES, M. D.

Much attention has lately been drawn, both in England and America, but especially in the latter country, to the dangers to which workmen and others are exposed when handling and working with wires, dynamos, and other apparatus connected with the generation and supply of electric currents for light and power. A lively controversy regarding the relative safety of continuous or alternating currents has resulted; but little, if anything, has been done to throw direct light upon the matter, and great difficulty is therefore experienced by disinterested persons in arriving at a satisfactory conclusion.

It is with great diffidence that we venture to offer this short paper on the subject. as the experiments and observations upon which our contribution is based were not specially undertaken with the object of throwing light upon it. They form part of a series of data connected with investigations upon which we are engaged with the hope of solving some of the physiological problems occurring in the course of our electro-therapeutic work at the Institute of Medical Electricity.

The results obtained from some of our experiments (hereinafter given in detail) led us to note how strongly they bore on the question now before us. We therefore, after verifying them by repetition, thought it well to invite discussion upon them, and now offer them for your consideration, with full consciousness of their imperfection. They differ from the experiments of D'Arsonval, Harold P. Browne and others in the important point that they deal not with the bodies of rabbits, dogs and horses, or other animals (from which conclusions regarding human life have to be evolved), but directly with the human body.

We do not in any way propose to touch upon the question of the manner in which accidents with electric wires, etc., occur, or how they may be prevented. It would be manifestly beyond our province to do so. Our object is rather to compare the physiological action of the two forms of current *after the contact*, accidental or otherwise, has been made, and to arrive at some conclusion as to the danger ratio which one form of current may bear to the other under such conditions.

As may already have been gleaned, our experiments have not been made with the powerful currents dealt with in electric lighting and distribution of power. We have used small currents, for the most at low E. M. F., and have directed our attention to (1) the determination of the resistance of the human body and skin to the passage of currents under certain conditions; and (2) a comparison of the sensations produced in the human body by passage of the two forms of current.

1. With regard to the resistance of the human body and skin. In his Lumleian Lectures, delivered before the Royal College of Physicians in April, 1886, Dr. W. H. Stone gave some very useful information. His experiments appear to have been carried out with care, and the results, therefore, are trustworthy. In the course of many similar experiments we find no reason to differ in the main from the figures he has arrived at, and we quote those that refer to our immediate subject in the following table:

TABLE A.

	Resistance, Foot to Foot.	Resistance, Foot to Hand.
Mr. T.	945 ohms.	1,320 ohms.
Mr. S.	930 "	1,027 "
Hungarian Giant	930 "	1,032 "

There is, however, this important fact to be taken into account when considering the bearing these figures have on the present question, viz.: that Dr. Stone, having a direct therapeutic object in view, was dealing, as far as he could, with the internal resistance of the body, and not with its total resistance as represented by that of internal tissues and skin in its normal insulating condition. Further, Dr. Stone's experiments were scarcely typical of results to be expected from either purely continuous or purely alternating currents, for in his lecture he says, with reference to the experiments quoted in Table A, that he had in "circuit a Wheatstone bridge of a rather particular form, a commutating key so as to send the current in opposite directions, etc."

Some experiments conducted by Mr. Wm. Lant Carpenter, however, are more in accordance with the conditions which this paper is intended to illustrate, as they enable us to form some clear idea of the nature of the current actually used. The results of these experiments are shown in

TABLE B.—CONTINUOUS CURRENTS.

	Resistance from foot to foot in ohms.		Resistance from foot to foot in ohms.
Dry skin	— min	10,300	30 min 1,400
Salt and water	1 "	4,300	35 " 1,290
" " "	5 "	2,500	40 " 1,250
" " "	7 "	2,100	45 " 1,230
" " "	10 "	1,900	50 " 1,200
" " "	15 "	1,720	60 " 1,190
" " "	20 "	1,540	to 1,200
" " "	25 "	1,470	

Our own experiments have been made with the skin normally dry and moist, and we have selected measurements taken from hand to hand, as the hands are the parts most likely to come into contact with wires and other conductors.

The first series of readings are those of resistance to continuous current. They were taken by the ordinary Wheatstone bridge method with a mirror galvanometer. Tin electrodes, each of 50 square centimetre area, were used, the extended palms being placed upon the electrodes.

The results are shown in

TABLE C.—RESISTANCE TO CONTINUOUS CURRENTS.

Subject.	Age about.	Dry.	Moist with Distilled Water.	Moist with Salt Water.
	Years.	Ohms.	Ohms.	Ohms.
1	35	30,000	19,700	9,170
2	22	49,000	7,700	5,900
3	35	41,400	23,000	11,000
4	38	40,000	11,500	5,900
5	35	50,000	9,500	5,000
6	40	45,000	30,400	26,400
7	21	19,000	7,600	6,700
8	22	27,000	25,400	12,000
9	26	31,000	7,000	6,500
10	24	40,000	10,700	7,000

* Paper read before the Institution of Electrical Engineers, London, March 27, 1890.

In estimating the measurement of resistance to the continuous current, we must remember that, as the result of the almost instantaneous congestion that follows the closing of the circuit, resistance is to a certain extent diminished.

Very shortly this is succeeded by polarization and by the conditions that accompany the conversion of the body into a secondary battery, and there is consequently a considerable increase in resistance when the passage of current is continued for an appreciable time. On the other hand, the passage of alternating currents is accompanied by a diminishing resistance from the outset, for the early physiological congestion is followed neither by polarization nor by the elecrolytic action that it is usual to expect when the continuous current is used.

Table D shows the resistance to alternating currents of the same ten people taken with the same electrodes on the same occasion as those referred to in Table C.

TABLE D.—ALTERNATING CURRENTS.

Subject.	Dry.	Moist with Distilled Water.	Moist with Salt Water.
	Ohms.	Ohms.	Ohms.
1	2,900	2,500	1,500
2	10,400	1,800	1,200
3	5,500	1,600	1,400
4	2,500	2,200	1,200
5	5,400	1,600	1,500
6	2,600	1,700	1,300
7	1,400	1,450	1,250
8	2,350	1,500	1,400
9	3,500	1,500	1,600
10	5,000	1,375	1,500

Tables C and D are fairly comparable as regards the same individuals, though the maximal differences are strongly marked.

Dr Stone, in his lecture above referred to, mentioned a very important fact, which since appears to have been overlooked, viz.: that (under the conditions he adopted) the resistance of the human body was only about half as great for alternating currents as for the continuous current. This statement we have never seen questioned, and our own experiments show that under conditions more assimilating to those likely to occur in practical work, the proportion is considerably greater. Table D shows wide variations in the resistance of the individual tested, as well as other peculiarities that are no doubt partly due to errors of observation, but more largely due to physiological conditions which are scarcely relevant to this paper; but the tremendous difference between the resistance to alternating currents and the resistance to the continuous current is clearly and definitely marked, and justifies us in drawing certain conclusions therefrom. We find the—

	Ohms.
Average resistance to the continuous current, moist with salt and water	9,557
Average resistance to the alternating current, moist with salt and water	1,405
Average resistance to the continuous current, moist with distilled water	15,250
Average resistance to the alternating current, moist with distilled water	1,722
Average resistance to the continuous current, dry	38,140
" " " alternating " "	4,155

When this condition of things became apparent, we thought it well to confirm our experiments by repeating them as far as possible under conditions such as would occur in actual working.

The results of this set of control experiments we give in Table E. The 10 persons tested were chosen so as to be, as far as possible, representatives of those likely to come in contact with electric light and power wires and other conductors. Five were workmen with hands hardened, and rendered by toil, as far as may be, insensitive to electric currents. The other five were men accustomed to brain work, and may be taken as representing the occupiers of houses likely to use the electric light, and occasionally to come in contact with the leads, terminals, lamps, etc., of house installations.

The electrodes used were of plain metal, and could be grasped in the hand, and so may be taken to represent the metal about a dynamo, or a bare wire or other conductor, which might be grasped accidentally by a workman occupied about a lighting or power station, or by a gentleman investigating some electrical irregularity in his own house.

The continuous-current tests were made with a Wheatstone bridge of post-office pattern, and a mirror galvanometer. The alternating-current tests were made with one of Kohlrausch's rheometers, in which the balance is observed through a telephone. The alternating currents obtained from the induction coil of the instrument had a periodic frequency of about 300 per second.

The dry readings were taken with normally dry hands. The moist readings were taken after the hands had been dipped into ordinary tap water.

TABLE E.

Subject.	Resistance in Ohms. Dry Hands.		Moistened Hands.	
	C.C.	A.C.	C.C.	A.C.
1	36,000	2,200	25,000	1,450
2	17,000	1,850	9,000	1,400
3	7,000	1,800	6,400	1,600
4	12,000	1,400	5,900	1,275
5	18,900	1,600	14,700	1,450
6	8,400	1,450	3,900	1,200
7	10,450	1,000	7,500	1,300
8	8,500	1,500	7,300	1,450
9	14,300	2,000	10,900	1,600
10	12,200	1,900	6,900	1,650
Average	14,475	1,740	9,750	1,437

These results indicate that the resistance of the human body to continuous current is 6.8 times greater than it is to alternating currents when the skin is moistened, and 8.3 times greater when the skin is in its normal condition and not moistened by artificial means.

Starting with the statement of Dr. Stone, that when the skin has been well soaked with a conducting fluid, and electrodes of large area are used, so that little, if any, more than the internal resistance of the body comes under observation, the resistance to the continuous current is nearly double that to alternating currents, we find that the ratio increases conversely with the moisture of the skin, till in the normal condition we reach the maximum of 9.1 for contact of small area, and 8.3 for contact obtained under ordinary working conditions.

We now come to the second part of our subject, viz.: a comparison of the sensations produced in the body by the passage of the two forms of current.

The sensitiveness of persons to the continuous current varies very much, quite independently of variation of resistance. But we find that most people (and we have tested some hundreds) can bear without discomfort the passage of 10 milliampères for a short time, and for the purpose of this paper we will consider that amount of

current-strength as the maximum which may be passed through the body without producing unpleasant sensations.

With alternating currents, however, a very different state of things is disclosed; for having in the course of our therapeutic work found the great need for accurately measuring the alternating currents from induction coils, we obtained from Germany (after failing to find a suitable instrument of English make) a galvanometer recording milliampères of alternating currents, and on putting it in circuit with a patient, were surprised to note that before the needle indicated the passage of a single milliampère the patient complained that the current was too strong, and practically unbearable.

This, of course, led to further investigation, with the result that, though we tested a large number of persons of varied ages and of both sexes, we found only a few who could bear with comfort the passage of one milliampère of alternating currents.

Table F shows the result of sensation tests made upon the ten subjects above referred to.

TABLE F.—SENSATION TESTS.

	Without Discomfort.		Muscular Fixation.
Subject.	C.C. Ma.	A.C. Ma.	A.C. Ma.
1	10.0	2.0	4.5
2	10.0	2.0	3.0
3	10.0	2.5	3.75
4	10.0	1.0	2.75
5	10.0	1.0	2.0
6	10.0	2.0	3.25
7	10.0	2.5	6.0
8	10.0	2.0	4.5
9	10.0	1.0	2.25
10	10.0	1.0	4.0
Average	10.0	1.7	3.6

[Experimental sensation tests were here shown.]

So far we seem to be justified in putting the limit for alternating currents at two millampères, and we wish it to be understood that any advance upon this limit means extreme discomfort. Beyond that point violent muscular contraction, rendering relaxation of grasp first difficult, and then impossible, produces distinct pain, which agitates the whole body. We can therefore confidently state that, as far as sensations are concerned, the human body can bear with ease at least five times as much of continuous-current strength as of alternating-current strength. When this fact is taken in connection with the great difference in the resistance offered by the body to the two forms of current, it leads to the conclusion that the danger of unpleasant consequences, and possibly (if not probably) of loss of life when currents of equal voltage are handled, is 34 times (6.8×5) greater with moist hands, and 41.5 times (8.3×5) greater with dry hands, when alternating currents are used than when the continuous current is employed. These figures we will adopt as representing the *danger-ratio*.

As a practical example of this conclusion we may take the Board of Trade limit of pressure at which currents may enter houses, viz.: 200 volts, and assume that a man having the average resistance taken from Table E handles naked wires within the house.

With the continuous current (dry hands) $C = \frac{200}{14,475} = 13.5$ milliampères. He thus receives only 13.5 milliampères, which is little more than, as shown above, he can take with perfect impunity.

With alternating current (dry hands) $C = \frac{200}{1,740} = 115$ milliampères. He thus receives 57 *times more current* than he can bear without discomfort, and the danger of physiological shock is correspondingly increased.

It may be objected that all this has little relevancy when large currents of either kind, at high potentials, have to be dealt with; but we would submit that what we have proved to be the case with small circuits and low potentials, may be fairly taken to be intensified as the current strength and E. M. F. increase. There is at present no reason to suppose that the ratio of resistance diminishes, or that of the sensations become lessened, though it may possibly happen that with increased current strength, or higher potential, the absolute resistance may vary.

What the minimum current of either kind which will destroy human life may be, we are not in a position to say; though D'Arsonval, in his report on electro-physiology made before the International Congress of Electricians held at Paris, 1889, says, referring to his experiments on rabbits, guinea pigs, and dogs: "With a machine of 8,000 volts a momentary closing of the current caused the animal (a rabbit) to make a prodigious leap, but did not cause death immediately; a second application was necessary." "An alternating Gramme machine only causes death above 120 volts mean potential." These statements are not very clear, but we gather therefrom that while a continuous current machine having an E. M. F. of 8,000 volts did not instantly kill a rabbit, yet an alternating current machine having a mean potential of 120 volts did. We feel sure that no hard and fast lines can be laid down on the subject. Individual resistance and individual sensitiveness vary so much and so unexpectedly that a current that might be taken with impunity by one person might be more than enough to kill another.

With regard to danger ratio, D'Arsonval seems to more than bear out the conclusion that we have arrived at, though he gives no information as to the current strength used. Independently of the kind of current used, the character of the contact made, the surface area of the body involved, and the suddenness of closing or opening the circuit must each and all play an important part in the result. Shock varies with the form of current employed; thus with continuous current only a "make" initial shock is possible, while with alternating currents the initial shock may be either a "make" or a "break" shock. As "break" shock is admitted to be the more marked of the two, independently of the steady diminution of resistance to alternating current, it is probable that the effects of an initial shock with alternating currents of similar strength may be more disastrous than that with continuous current.

Mr. Glasier's Death.

Mr. Harry A. Glasier, the Western representative of J. A. Grant & Co., Boston, and formerly vice-president of the Jarvis Engineering Company, died at his residence, 3024 Prairie avenue, Chicago, early Tuesday morning, the 15th inst., after an illness of but a few hours' duration, due to heart trouble. About five o'clock the previous evening Mr. Glasier complained of feeling ill; twelve hours later he had breathed his last. Among the steam power users he was one of the best known men in his line of business, and was respected both for his honorable and successful business qualifications and for his genial social nature. He was in his fiftieth year and leaves a widow and two sons. Mr. Glasier was one of the promoters of the Chicago Electric Club, and his name had been added to the list of managers to be voted for this week. Immediately upon being notified of his death, a special meeting of the board of managers of the club was called, and the following committee appointed and empowered to take such action as would seem advisable: Mr. Alexander Kempt, chairman, and Messrs. F. E. Degenhardt, W. A. Kreidler, C. H. Cone and Fred DeLand. The committee visited the residence, and, finding Mrs. Glasier prostrated by the shock of her sudden bereavement, made all necessary arrangements for the funeral, which occurred Friday morning, when a large number of friends and club members followed the remains to their last resting-place. Messrs. Beach, Kempt, Martin, Cutter, Walker, Haskins, Kreidler and DeLand were the pall-bearers.

The Senate Committee on General Laws; Investigation on Electric Traction, Gas and Steam.

It will be remembered that some few weeks ago the Senate Committee on General Laws held a series of investigations at the Hotel Metropole, to determine the relative advisability of overhead and underground electric wires for light and power in this city. The report of this commission was afterward presented to the Senate, and a further result was the introduction, last week, of a bill by Senator Erwin, creating a State Electrical Commission.

The sittings of the committee were resumed on the 19th, at the Metropole, Senators Vedder, Coggeshall and Chase being present.

Senator Coggeshall said that the investigation about to be entered on would have a special bearing on the use of electricity as a motive power for street cars and its incidental conditions. Much of the testimony that had already been taken had pointed to the probability of the subway explosions being mainly, if not altogether, due to the escape of gas from badly constructed and impaired pipes. This escaping gas and the steam that escaped from the pipes of the steam heating companies constituted a source of danger to life and property for which a remedy was imperatively needed, and the object of the commission was to hear the testimony of experts who had been called upon to attend, with a view to establishing a supervisory board over the electric railroads and steam and gas companies, and to define the scope and authority of that board.

Stephen McCormick, superintendent of the Bureau of Lamps and Gas in the Department of Public Works, said that after fourteen years' close observation of the causes of gas leakage in this city, he was of opinion that the mains had been properly constructed when first laid, but that the many contiguous excavations had shakened and weakened them. He further thought that the construction of the subways was accountable for much of the damage suffered by the gas pipes, and consequent leakage, as the pipes had been roughly handled by the subway workmen. The average leakage of gas in New York city was 10 per cent. At present the gas companies were under no control, so far as the city authority was concerned. In case of leakage all that could be done was for the Department of Public Works to notify the gas companies of the fact. If they repaired the leak, well and good, but if they did not it simply remained. Although the gas companies were anxious to stop leakage, it was most desirable that the Public Works Commissioner should have an appreciable and well defined control over them. When questioned as to the relative value of cast-iron and wrought-iron pipes, the witness said that the cast-iron mains lasted the longest, but that the wrought iron made the better joints. The length of gas mains in New York city and the immediate vicinity is about 1,200 miles; 1,123 miles on Manhattan Island and 105 miles in the annexed district. The Board of Health paid a great deal more attention nowadays to the plumbing in houses than they did to the gas fixtures. A great number of deaths from gas in private houses is due to there being no stops in the gas cocks, and this is a point on which the Board of Health would do well to bestow attention.

H. B. Ford testified that the voltage of electricity required to kill a man could not definitely be determined. There was not much danger of ignition of escaped gas underground by electric sparks. The health and life of the public were much more imperilled by the escaping gas than by explosions. Witness was not prepared with any suggestion as to the advisability of using guard wires to insure the non-contact of the telephone and telegraph wires and the overhead electric railway conductors. Witness believed in the wisdom of establishing some official supervision over the electrical and gas companies.

Frank J. Sprague gave some valuable testimony as to the development during the last three or four years of the electric railways, in which the Sprague Electric Railway and Motor Company, of which he is vice-president, has taken such a leading part. Mr. Sprague described the three systems of electric street car propulsion now in vogue, the overhead, conduit and storage battery. The conduit system had failed hitherto from two main causes: imperfect construction, and lack of proper drainage. In low-lying or uneven land, the water would get into the conduits, the wires would be short-circuited, and of course, the system would become inoperative. The cost of a single conduit track on Broadway might range from $70,000 to $150,000 per mile. There are 140 towns or cities in the United States where electric railroads are operated. The number of roads is about 225, and the mileage covered per day by these roads is 150,000. Each car represents an expenditure of $15,000 to $20,000, and there are about 2,000 cars in use. The average voltage of electric street car wires is from 400 to 500. Witness and all his employés had frequently received shocks, but he had never known either death or serious injury to result from contact with street car wires. Guard wires might in some cases be used with advantage, but a most important step in securing additional safety would be taken in the bestowal of greater care on the erection of telephone and telegraph lines.

These have hitherto, in many cases, contained culpably bad workmanship, and have constituted a menace to the safety of the public. Wherever another wire came in contact with the bare overhead conductor the danger of fire arose. The storage battery system is not yet reduced to a commercial basis. The great drawback hitherto has been the weight of the batteries necessary. There are to-day not more than ten cars run on the storage battery system. The Sprague Company has spent considerable money in experimenting with storage batteries, but has not had satisfactory results, and are using now only the overhead system.

The question of the successful working of the subways was simply a question of spending money enough on them.

The advisibility of placing the wires overhead or underground was entirely dependent on conditions. In a crowded thoroughfare like Broadway, an underground service might be preferable, while in outlying districts and in the country the overhead service would have manifest advantages. Witness thought that there should be a power given to a suitable board to determine to just what extent the wires should be put underground. The safety of the life and property of the people would not necessarily be increased by generally placing the wires underground. An overhead line could be put up with reasonable safety.

The whole onus of the accidents that occurred should not be put on the electric light companies; when the trouble arose from interference by the telephone and telegraph wires, the responsibility should be fairly apportioned. One of the most important provisions in the establishment of any supervisory body in the future was that it should have the power of compelling good workmanship on the lines that were run.

W. C. Andrews, president of the New York Steam Company, thought there was no necessity to establish additional supervision over steam, gas and electrical companies; they had sufficient responsibility already.

"The astonishing thing to me is," said Mr. Andrews, "why you don't investigate the dangers of horse cars. They have killed more than gas and all the other things put together in the last couple of years."

"What would you suggest as a remedy?"

"I don't suggest. I am not in the horse car business; but I simply state it as a fact. Electricity or the cable system would be safer."

The investigation was adjourned to the 22d inst.

Lighting (?) New York.

The Gas Commission, at its meeting April 18, virtually decided to reject all the bids lately put in for lighting the streets by electricity, and all three members, Mayor Grant, Commissioner Gilroy and Comptroller Myers, expressed themselves as ready to resume the use of gas lamps throughout the whole of the city rather than pay the prices demanded by the electric light companies. The bids nearly all showed an increase from 35 to 39 cents per night per lamp. Commissioner Gilroy moved that all the bids be laid over indefinitely. His colleagues on the Board acquiesced. Mr. Leslie, representing the Harlem Company, then asked to be allowed to read a statement to show that the advance in price asked for was justified because of the increased expenses due to the subway rent.

Commissioner Gilroy pointed out that in many cases the company bidding had no wires of its own along the line it proposed to light, but that other companies had. "There has doubtless been a combination," said Mayor Grant, "and I am prepared to vote at once to light the city by gas."

Mr. Leslie declared that operating through the subways increased the nightly cost of a lamp 11 cents and a fraction; but Comptroller Myers pointed out the fact that the lessened cost of repairs had not been taken into consideration. Then the Board laid over the bids indefinitely.

Ex-Justice Kelly, who appeared for the East River Company, suggested that the question whether or not the advanced price was justified be submitted to a competent electrical engineer, to report to the Board; but the Mayor declared that he was convinced that a combination had been formed, and he wanted nothing further said on the subject.

The bid of the Equitable Gas Company for furnishing over 3,000 lamps with gas at $12 a year for each lamp, was accepted. The Standard Gas Company had put in no bid. Its franchise stipulates that it shall not charge the city more than $12.50 a lamp. It was resolved to take steps to compel the company to furnish the Commission with a record of its mains and through what streets they run, and to light such lamps in these streets as have not already been contracted for by the Equitable Company.

The Electrical Section of the Census.

The managers of the census of 1890 evince a determination to do full justice to the electrical enterprises of the country, and to collect as complete a set of statistics and data as can be obtained in regard to the most rapidly developing interest in America. The fullest encouragement should be given to the efforts of the census bureau, and the result should be a series of tables as noteworthy as any in the entire report.

Mr. Allen R. Foote, special agent, informs us that the following schedules have been completed and a copy is now ready for the printer:

1. Manufacturers of electrical apparatus, instruments and supplies.
2. Electric light and power central stations.
3. Fires caused by electric currents. Information to be obtained from electric central station companies.
4. Fatal casualties occurring on electric currents. Information from the same source.
5. Fires caused by electric currents. Similar investigation.
6. Fatal casualties occurring on electric currents. Special investigation in cities of 10,000 population and over.
7. Isolated electric lighting and power plants.
8. Educational institutions. Electrical engineering courses.

The schedule for central station companies required infinitely more work for its preparation than any other. While in preparation it was shown to a large number of managers of central station companies and others, and full benefit has been taken of every suggestion offered. Every possible effort has been made to render it full, plain, complete and practical. The range of inquiries in the complete schedule necessarily covers all apparatus and service that a central station company may have in use.

The electrical schedule will be sub-divided as follows: 1, underground conduits; 2, underground conductors; 3, aerial conductors; 4, incandescent lamps; 5, arc lamps; 6, converters; 7, accumulators; 8, meters; 9, stationary motors; 10, currents supplied to cars.

To avoid sending a company inquiries that do not pertain to its business, the schedule will be printed in sections. To ascertain what section to send to each company, the following inquiries are being sent out to be answered at once:

1. Do you own or operate underground conduits?
2. Do you operate incandescent lamps?
3. Do you operate arc lamps?
4. Do you operate a converter system?
5. Do you operate an accumulator system?
6. Do you operate stationary electric motors?
7. Do you operate or supply current to electric motor cars?
8. Are you making or do you contemplate making additions to your plant during the year 1890? If so, please state of what the additions will consist, and give the total amount of estimated cost.

The returns from the preliminary schedules sent out in February and March are quite satisfactory. An official directory of electric central station companies is now being compiled from these schedules and all other sources of information at command. If any company has failed to return the preliminary schedule, it will oblige the office greatly by doing so at once. In case a company has failed to receive this schedule, one will be forwarded at once if it will kindly give notice of the fact. All companies are earnestly requested to notice carefully the way their names are written on all papers addressed to them and to make needed corrections in their replies. With such assistance and due diligence in the office, a creditable degree of correctness may be attained.

The schedules that have been prepared outline only a portion of the work. To subdivide the inquiries for manufactures, directories are being compiled as follows:

Directories of manufacturers: 1. Dynamos. 2. Motors. 3. Incandescent lamps. 4. Arc lamps. 5. Carbons. 6. Insulated conductors for electric currents. 7. Conduits. 8. Primary cells. 9. Accumulator cells. 10. Electric meters. 11. Electric clocks. 12. Electric welding apparatus. 13. Electro-plating machines. 14. Electric fire alarms. 15. Electric burglar alarms. 16. Electrical apparatus for use in medicine and surgery. 17. Electrical instruments.

Extended as this last is, it requires many additions to make it complete.

A letter has been addressed to each manufacturer, requesting him to assist in furnishing information for a chapter in the census report, on the "Manufacture and Uses" of the special apparatus named. This letter solicits:

1. A list of all manufacturers of the apparatus.
2. A list of the addresses of all users of the apparatus when this is practicable, together with a statement of the purposes for which it is being used.
3. A full description of any novel or special use being made of the apparatus.
4. Suggestions of pertinent inquiries for a schedule to be sent to manufacturers and also for a schedule to be sent to users of the apparatus when desirable, for the purpose of obtaining information considered to be important.

It is very clear that this invitation affords manufacturers an opportunity to furnish information, the publication of which will be a revelation, not to laymen alone, but to those most familiar with the progress being made in adapting electrical energy to the services of civilized life. Such a publication will vastly increase popular knowledge and appreciation of the advantages and value to be derived from the manifold uses of electricity. It will furnish a solid basis of facts for all arguments. Its impersonal and impartial character will convince the public of its truth; it will set at rest all doubts and fears. Future public action guided by it, dealing with electrical interests, will be intelligent and consistent with the people's welfare. A truthful statement showing what electricity is doing, as it will be told in these chapters and others to be formed, will be enormously valuable to the people of this country.

The day is not distant when the economic value of applied electricity will be known to exceed that of the output of all mines of gold and silver; its ministrations to health, to be more potent than all other remedies; and when all peoples will be made neighbors and friends by its matchless power to convey intelligence and persons. When that day comes, he who attempts to cast odium upon any form of the apparatus through which electricity manifests its helpful power, or seeks to block its progressive development by raising false danger-signals, will be known and shunned as an enemy to public welfare.

ALLEN R. FOOTE,
Special Agent.

Insulation in Heated Subways.

The following special test, made by Wm. Maver, Jr., of "Safety" cable, lead covered, manufactured for the Mt. Morris Electric Light Company, and in the subways in Fourteenth street from Sixth avenue to Broadway, and Broadway from Fourteenth street to Beaver street, will be of interest to those who walk our streets in momentary fear of explosions.

The tests were made to ascertain the effect, if any, of the high temperature of the subways, due to proximity to steam-heating mains, upon the insulation of cables, as might be indicated by a fall of insulation resistance.

Wednesday, March 26, 1890, 2.30 p. m. Location of testing place, Duane street near Broadway (basement plumber's shop.) Constant 25,000 megohms.

First Test.—Conductor A, No. 6 B. & S. In subway from Duane to Beaver street, Broadway. Total insulation resistance after one minute electrification, 1,250 megohms. Estimating length of conductor as 8-10 mile, insulation resistance per mile, 1,000 megohms.

Second Test—Conductor B, No. 2 B. & S. In subway parallel with conductor A, from Duane street to Beaver. Total insulation resistance after one minue electrification, 1,250 megohms. Insulation resistance per mile, 1,000 megohms.

Third Test.—Conductors A and B tested together. Length 1.6 miles. Total insulation resistance after one minute, 625 megohms. Insulation resistance per mile, 1,000 megohms.

Fourth Test.—Conductor C, No. 2 B. & S. In subway from Duane and Broadway to 14th street and 6th avenue. Estimated length, 2.2 miles. Total insulation resistance after one minute, 833 megohms. Insulation resistance per mile, 1832-6 megohms.

Fifth Test.—Conductor D, No. 6 B. & S. In subway, from Duane to Houston streets. Estimated length .75 mile. Total insulation resistance after one minute, 2,500 megohms. Insulation resistance per mile, 1875 meghoms.

Sixth Test.—Conductors C and D tested together. Estimated length 2.95 miles. Total insulation resistance after one minute, 625 megohms. Insulation resistance per mile, 1,843 megohms.

Seventh Test.—Conductors A B C D, tested together. Estimated length, 4.55 miles; 1.6 miles of same in heated district. Total insulation resistance after one minute, 312.4 megohms. Insulation resistance per mile, 1421.8 megohms.

Tests closed 4.45 P. M.

Conductors A and D will be joined up as part of one circuit, B and C as part of another.

"The temperature in some of the manholes," adds Mr. Maver, "has been found by actual measurement to exceed 150 deg. F. The results of tests show an insulation resistance of all the conductors much higher than is required by the subway rules. The conductors tested had been in the subways, heated districts included, a sufficient time, in my opinion, to develop any tendency to a marked fall in the insulation due to increased temperature if such fall were to follow the placing of the cables in the heated area."

Rights of Telegraph Companies on Highways.

The Virginia Supreme Court recently delivered an opinion in the case of the Western Union Telegraph Company against Williams, on an appeal from the Circuit Court of New Kent county, affirming the judgment of the lower court.

The question involved was the right of a telegraph company to construct and maintain its line along the public road without compensation to the land owners on either side, provided the line did not obstruct the ordinary use of the road.

The main positions contended for by the telegraph company and held by the dissenting judges were that when the land was originally condemned for a public road, the landowner parted with as much of his rights therein as the public might need for purposes of "*intercommunication*," and that these purposes included not only the transfer of passengers and freights, but also of *intelligence—e. g.*, the mails; that when this public right of user was thus created it at once passed under the control of the Legislature, who might authorize the use of it in furtherance of intercommunication, in any way, by any corporation, or by any means or mode which advancing civilization might invent or employ, provided the new mode did not interfere with the old mode of using the highway, and did not take any more of the soil than the land owner had originally devoted to the public use.

It is claimed that the majority opinion does not distinctly discriminate "between highways in the country and streets within the limits of cities or towns," and that the minority opinion does distinctly repudiate any such distinction, saying: "As both the highway and the street are opened for the same general purpose—and a street is a highway—there would seem to be no sound basis for such a distinction."

If this be true, is not every improvement of city street as well as country road in Virginia involved? Does not the decision give a *prima-facie* claim for damages for the erection of every gas lamp and electric light or power pole and the laying of every gas and water main and sewer in every city and town in the Commonwealth—at least where, as often occurs in Virginia, land originally dedicated as a country road has been changed imperceptibly into a town or city street?

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-177 TIMES BUILDING, NEW YORK, April 19, 1890.

The Standard Underground Conduit Company will have a fine suite of offices in the *Times* building May 1.

The Standard Underground Cable Company, G. L. Wiley, manager, will move to the *Times* building May 1.

The Ball Electric Light Company, 18 Cortlandt street, will shortly move to more commodious quarters, at No. 404 West Twenty-seventh street.

Mr. Merrill will shortly move the New York agency and salesrooms of the Underwood Cotton Leather Belting Company to 73 Cortlandt street.

Mr. George B. Prescott, Jr., an expert electrician, has been secured by the Walker Electric Company, 50 Broadway, as their consulting electrician.

The National Conduit Manufacturing Company, J. P. McQuade, general manager, will move to a new suite of fine offices and salesrooms in the *Times* building May 1.

W. R. Ostrander & Co., manufacturers of speaking tubes, electric bells, etc., will move May 1 from 21 Ann street to Nos. 195 and 197 Fulton street, where they will carry a full line of their specialties.

The Litofuge Manufacturing Company, 53 Cedar street, makers of boiler compound highly recommended by some of the largest electric light companies, are about to move to more commodious quarters at No. 62 John street.

The A. B. C. Motor Company, 44 Gold street, is prepared to take orders for 1-12 to 1 h. p. motors, and deliver them promptly. Special provision has been made for filling immediate orders for any quantity of small motors and fan outfits.

The Magnolia Anti-Friction Metal Company is sending to its friends a romance entitled "Luxilla." It is a handsome book and said to be interesting. Any one who will send the company three cents for postage will receive a copy by return mail.

Mr. M. W. Corbitt, formerly with the Empire City Electric Company, has become a representative of the United Edison Manufacturing Company, 65 Fifth avenue, and will make his first trip to Toronto, Canada. Mr. Corbitt is always to be found at his post of duty.

The Smith Electric Conduit System, 120 Broadway, will move to Temple Court, Nassau and Beekman streets, May 1. Mr. Harry W. Smith, Newark, is the inventor, and E. O. Chase, model maker, is the builder of the section on exhibition and in practical operation in Newark.

C. S. Van Nuis can be found nicely settled in his new salesrooms at 76 Cortlandt street, where he has on exhibition a large line of his popular electric light power and railway switches. Mr. Van Nuis is constantly adding to his line of switches various new styles and designs.

The Fibrone Manufacturing Company, 35 Warren street, is introducing, particularly to electricians, a new substance which they believe has many advantages over hard rubber in electrical work. Its cost is materially less than that of rubber, and it is expected to be very extensively used.

Crocker & Wheeler Electric Motor Company have moved to their large and extensive factories, 430-432 West Fourteenth street, 429-431 West Thirteenth street and 857-877 Washington street, they having outgrown in less than one year their old quarters 322 and 324 Seventh Avenue.

The National Electrical Manufacturing Company, successors to the electrical department of the New Haven Clock Company, 25 Murray street, has leased the extensive lofts, 14-16 Vesey street, and will move about May 1. This company is doing an extensive business, and is months behind in its orders.

The Alpha Faradic Battery is the result of many inquiries for a trustworthy and cheap battery, particularly for family use. Its owners, the Smith & Shaw Electric Company, have recently removed from 135 Seventh avenue to 610 Eighth avenue. Henry Schwindt is the manufacturer of this excellent little battery.

Chapin & Thompson, successors to Sibley & Chapin, 602 West Twenty-second street, are devoting their time to contracting to build special machinery, experimental work, models, etc., and have secured the services of the assistant superintendent of Wm. Sellers & Co., who has had large experience in the manufacture of delicate and intricate machinery.

An Interesting Lecture.—On Friday last Dr. Schuyler S. Wheeler delivered an address before the Harlem Young Men's Christian Association upon electricity. Dr. Wheeler showed to an amused and delighted gathering a large number of electrical appliances, and explained their workings in a lucid manner. It is not usual to find an expert who can thus make abstruse questions both simple and interesting to laymen.

The Safety Insulated Wire and Cable Company, 234 West Twenty-ninth street, have over 129 miles of cables in the conduits of New York City, in sizes, No. 00, No. 2, 4, 6 B. & S. gauge, lead covered. Some of these are guaranteed to carry 7,000 volts. Their Jumbo cable is of No. 4 conductor, is composed of 28-32 insulation, and taped and lead covered, solid seamless rubber cover, without any joints. They never allow a joint to remain in the cables in the conduit ducts, but make all joints in the manholes.

Benjamin Blum, 5 and 7 Dey street, manager of the Wenstrom Northern Electric Company, has been appointed general agent of the Wenstrom Consolidated Dynamo and Motor Company, of Baltimore, Md. Mr. Blum has had a long practical experience in the electrical supply business, having been connected with one of the largest supply houses in this city for a number of years. His early experience has served him well in promoting electrical specialties. He installed the first Wenstrom dynamo in this city.

The Sprague Company.—Among their recent contracts are the following: Augusta Street Railway, Augusta, Ga., 16 car equipments; Paducah Street Railway, Paducah, Ky., 9; Fort Worth and Arlington Heights Railway, Fort Worth, Tex., 3; Troy, & Lansingburg Railway, Troy, N. Y., 12; Metropolitan Railway, Portland, Oregon, 6; Passenger & Belt Railway, Lexington, Ky., 4; Atlantic City (N. J.), Electric Railway, 1; Detroit (Mich.), Rouge River & Dearborn Railway, 4; Union Street Railway, St. Joseph, Mo., 6; Sioux City (Ia.), Street Railway, 5; and Dallas (Tex.), Rapid Transit Railway, 1.

The Electric Club's annual election took place on Thursday evening, April 17. The report presented showed the finances of the club to be in a flourishing condition. The following officers were elected: President, O. E. Madden; vice-presidents, A. H. Patterson, Grosvenor P. Lowrey, Erastus Wiman and W. D. Sargent; secretary, Charles W. Price; treasurer, Willard L. Candee; board of managers, the officers and J. C. Chamberlain, H. L. Storke, John J. Carty, Cyrus O. Baker, Jr., J. H. Herrick, C. H. Barney, H. D. Stanley, H. C. Adams, George B. Coggeshall, Samuel Insull, John A. Seely, C. E. Stump and Henry A. Reed.

A. T. Smith, No. 6 West Fourteenth street, the manufacturer of lava tips, main line cut-offs, frictional machines, etc., for complete systems of electric gas lighting, and installer of electrical specialities of all kinds, is installing in the Museum of Natural History, Central Park, the passemeters, time detectors, electric call systems, time regulators, fire alarm system and annunciators; and also an electric bell call system that is in connection with speaking tubes connecting the 30 odd rooms with each other. The well known firm of architects, J. C. Cady & Co., who drew all the plans and specifications for this model building, are thoroughly conversant with electrical applications.

Wallace & Sons, formerly of Chambers street, have moved to larger quarters, 27 Chambers and 5 Reade streets, which they have renovated and decorated and refurnished in the best old oak furniture. Their general manager's office is a model headquarters, and has electrical communication with all the various salesmen's offices, as well as with the stock rooms in the basement, and in connection with the electrical communication, has speaking tubes so as to order the fulfillment immediately of special orders. Mr. H. B Hungerford, formerly of the Electrical Supply Company, will be found here, ready to meet inquiries and fulfill any of the requirements of the trade in his line, and particularly to supply immediate orders for the Little Joker dynamo. This house was established in 1848, and has very extensive mills in Ansonia, Conn., employing a large force of skilled mechanics, electricians, mill men, etc.

Mr. H. C. Whitney has lately returned from a very successfu trip in the interest of the Crosby Electric Company, *Judge* building, New York, and has made large sales of their dry battery. He has a fine testimonial from Dr. Otto Flemming of Philadelphia, who speaks in the highest terms of the life and work of this dry battery. Mr Whitney showed me an excellent novelty controlled by the Crosby Company—an electric call system to be used in connection with fire hose. The double conductors are carried through the whole length of the hose, with a contact rubber push button at the nozzle. When the firemen wants water he pushes the button according to a given signal; another signal turns it off; and a regular code can be arranged to call for the chief, help, etc. To secure perfect results a relay can be set on the engine. The two dry cells of battery at the nozzle operate the relay, which in turn closes a circuit on one cell of the dry battery and rings a 3-inch electric bell.

Loomis System.—The Eureka Electric Company, 18 Broadway, have just completed the installation of an electric plant for Messrs. A. R. Whitney & Co., at their Portage Mill at Duncansville, Pa., where one-half of the output of their automatic incandescent dynamos is in arc, and the balance in incandescent lights. They also installed at the same time for Messrs. McLanahan & Stone, at Hollidaysburg, Pa., one of their automatic incandescent dynamos, where one-third of the output is in arc, and the balance in incandescent lights. The company report the following plants recently installed and being installed: Wakefield Rattan Co., Wakefield, Mass., 500 lights; Ashley & Bailey, Paterson, N. J., 200 lights; J. & G. Fowler, Cuba, 150 lights; Thomas Oakes & Co., Bloomfield, N. J. 100 lights; Crown Mills, Marcellus, N. Y., 225 lights; Pioneer Silk Co., Paterson, N. J., 450 lights; Couterat & Co., West New York, N. J., 100 lights; Marion Cotton mills, Marion, S. C., 50 lights; Estate of William Astor, Schermerhorn Bldg., New York city, 400 lights; D. H. Jones & Co., Portland, Ore., 300 lights; Brown Bros. & Co.'s Banking House, Wall street, New York, 400 lights; Giles Lithographic Co., New York city, 100 lights; C. & W. K. Vanderbilt Vanderbilt Building, New York city, 450 lights; Robert MacKinnon, Little Falls, N. Y., 400 lights; James Bowers' Sons, Chester, Pa., 100 lights. J. Craig McLanahan, Pinkney, Tenn., 100 lights.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, cor. Franklin and Congress Sts.
BOSTON, April 16, 1890.

Auburn, Me.—The county buildings are to be lighted by electricity.

Fall River, Mass.—The *Tribune* is agitating for an electric railway.

Nantucket, Mass.—An electric railway will probably be built to Cissnonet.

Milford, Mass.—The Council has granted a franchise for a street railway.

Randolph, Me.—A new street railway is projected to run through this place.

The Tabernacle Church at Salem has an electric motor for operating the organ.

Manchester, N. H.—An electric railway will be built from Manchester to Lake Massabesic.

Blodgett Bros. have the contract to put 1,300 lights in the John Hancock Building, Boston.

An electric railway franchise has been granted for a road from Greenfield to Turner's Falls.

A patent for a new type of electric motor has been secured by Lawrence T Smith, of Providence, R. I.

The Massachusetts Legislature is considering a bill compelling all companies to mark or tag all wires in use.

Bellows Falls, Vt.—An appropriation has been made by the town authorities for 30 arc lights to light the streets.

The New Bedford Gas Company has placed poles over the north part of that city, where they will put electric lights.

Newburyport, Mass.—The High Street Railway Company will begin the construction of their electric railway at once.

Brighton, Mass.—The West End Railway has petitioned the Council for permission to build a double track railway here.

The earnings of the Eastern Electric Cable Company have increased during the first four months of this year about 67¼ per cent.

Greenfield, Mass.—A five years' contract with the Electric Lighting Company has finally been signed by the selectmen and the company.

Charles J. Van Depoele, of Lynn, Mass., has secured a patent for a suspended switch and traveling contact for electric railways.

Hingham, Mass.—The Town Committee on electric lights is locating the poles for lights on streets where the town voted to extend the system.

The Malden, Mass., Electric Light Co. has declared a quarterly dividend of two per cent., payable April 15 to stockholders on the books April 10.

A. L. Russell is having a large run on a new combination electric telegraph transmitter and indicator. It is of especial benefit in the matter of police alarms.

The Electrical Safety Company, which owns the Cartwright patent, has opened on office Room 21, Cook Building, corner Franklin and Congress streets.

Smith, Johnson & Daskam, General Agents of the Brown Electric Protector Company, of Philadelphia, have opened an office at 54 Devonshire street, Boston.

Seth W. Fuller has made the following installations within a short time: Chelsea City Hall, Catholic Seminary, Brighton and the Boston, Revere Beach & Lynn Railroad

The rise in the Bell Telephone stock, Saturday, was accompanied by rumors that there was to be an organized opposition to the company by owners of rival lines.

Waltham, Mass.—At a meeting of the Aldermen, April 14, a protest was received from the New England Telephone Company on the location of electric lights on the poles.

It is reported that the Standard Thermometer Company, of Peabody, Mass., have outgrown their present quarters, and are prospecting for a more eligible site elsewhere.

Mr. David Chalmers, of the Empire City Electric Company, of New York, was in Boston this week. He has many warm friends here who made his stay very pleasant.

Blake Bros. & Co. have purchased $500,000 worth of six per cent. bonds of the New England Telephone and Telegraph Company. The proceeds are to be used for construction purposes.

The Amesbury Electric Light Company proposes to supply the town of Merrimac with light, and to this end offers to increase its stock by $10,000, one-half to be taken by Merrimac gentlemen.

The New England Electric Safety Company, introducing the Crandall protector, have opened an office at 146 Franklin street, this city. Loren N. Downs and E. E. Zimmerman are the managers.

H. C. Swift & Co., owing to large orders and contract work, have been obliged to increase their facilities and will in a short time be able to turn out double the amount of work done at present.

The Edison Electric Illuminating Company, of Brockton, is making extensive improvements in its plant. A large amount will be laid out in alterations, and much new machinery added.

The Mason Regulator Company, 10 Central street, Boston, have as European agents the Crosby Steam Gauge Company, No 75 Queen Victoria street, London, and A. B. Reck, Gothersgade 155, Copenhagen.

Commodore Farquhar of the United States Navy, has been inspecting the Thomson electric welding process with a view to determining the advantages of combining lighting and welding in the various navy yards.

Col. Louis W. Burnham, vice-president and general manager of the Electric Gas Lighting Company, has returned from his trip South. Colonel Burnham is looking and feeling better and reports business as very active.

The Continental Telephone Company has declared a final dividend of $10 per share, preparatory to the dissolving of the corporation. The Tropical American Telephone Company is the successor and assignee of the Continental Company.

Rockville, Conn.—The new Merchants' Electric Company, of this city, has obtained a charter, having been incorporated under the laws of Maine to furnish electricity for various purposes. The capital of the new company is $25,000, and the stock is being rapidly taken.

The New England Printing Telegraph Company are to put 60 instruments in the principal towns and cities of Connecticut for the Connecticut State Press Association. The line is working nicely between Boston and New York, and the system has a great future.

Dover, N. H.—The city government has granted an exclusive franchise to the Consolidated Light and Power Co., to erect poles and wires for a term of ten years, and the Union Street Railroad between Great Falls and Dover, will be begun at once. It is to be completed before July 1st.

Worcester.—The Board of Aldermen have granted the petition of the Street Railway Company for the use of electricity as a motive power in operating its cars, under restrictions similar to West End Company's grant. It is not yet decided how soon the change from horse power will take place.

An order before the Boston Board of Aldermen, asking that permission be granted the Suburban Light and Power Company to erect 861 poles for the support of electric wires in certain streets in Roxbury, Dorchester, West Roxbury and South Boston was laid over, April 14, until the next meeting.

Mr. E. C. North has accepted the chairmanship of the New England Insurance Exchange Electric Light Committee, vice F. Barton, resigned to go with the New Mutual Electric Insurance Company. Mr. North is well known throughout New England, and has a host of friends, who extend best wishes.

The Beacon Vacuum Pump and Electric Manufacturing Company has been organized in this city with a capital stock of $1,000,000, and is to supply and operate the Berrenberg vacuum pump, of which some account was given last week, and which has attracted great attention, by reason of the remarkable results obtained in the public tests.

The Massachusetts Electrical Engineers' and Mechanics' Association held their third meeting at Brunswick Hall, 241 Tremont street, Thursday evening, April 17, and some forty names were added to the membership list. The association now has about 100 members. The next regular meeting will be held at the same hall on May 2.

H. H. Walters, general manager of the Card Electric Motor and Dynamo Company, of Cincinnati, while in town this week appointed W. J. Pilicy as his agent for New England, with office at 146 Franklin street. Mr. Walters expressed himself as very much pleased with the outlook for business in this section, and with the reception he received from electrical people in Boston.

Electric Road at Gardner, Me.—The chances are in favor of an electric street railroad being built in this city within a year. A. F. Gerald, of Fairfield, and several local capitalists are interested in the scheme, and a meeting will be called in a few days. It is proposed to run to South Gardner, five miles below the city proper, the new mills a mile from the city, and several other points.

Augusta, Me.—The Governor and Council have assessed the following taxes against telegraph and telephone companies of the State, the rate being 2¼ per cent.: New England Telephone and Telegraph Company, $1,650; Western Union Telegraph Company, $3,125; Maine Telegraph Company, $1,250; Great Northwestern, $125; Eastern Telegraph Company, $450; International Telegraph Company, $1,250.

The Page Belting Company, of Concord, N. H., report a large increase of business in March, 1890, as compared with March, 1889, especially in their Acme Link belt, which is well adapted for use on fast running machines like dynamos. Their new store in Chicago, at No. 165 Lake street, under F. F. Warmer, is developing their northwestern trade, large shipments having been made during March to Portland, Ore., and San Francisco.

The annual meeting of the stockholders of the Thomson-Houston Electric Company was held at Middletown, Conn., on April 15, at which more than three-fourths of the stock of the company was represented. The report of the treasurer was read and accepted. The following named gentlemen were elected directors for the ensuing year: H. A. Pevear, C. A. Coffin, B. F. Spinney C. H. Newhall, E. Thomson, S. A. Barton, J. N. Smith.

New Britain, Conn.—It is reported that the River and Rail Electric Company is to locate in this city, having taken the shops of the old Taylor Manufacturing Company on Stanley street. This is the company heretofore announced as being about to locate in Newington, Conn. The company owns and contracts patents of Prof. Mains, of New Jersey, who claims a new invention in storage batteries by which their weight is greatly reduced and their efficiency greatly increased.

The New Electric Mutual Insurance Company have opened an office at 85 Water street, Room 50. Their business will be insuring electric light and power stations and their contents, also overhead lines and all outside apparatus against loss or damage by fire. The officers are Stephen E. Barton, President; Everett W. Burdett, Vice President; Herbert H. Fairbanks, Secretary and Treasurer; Wm. Brophy, Chief Inspector; with a number of well-known New England gentlemen in the board of directors.

The Dennison Electrical Manufacturing Company, contractors and manufacturers of electrical supplies, conductors, insulators, electrical cables, etc., have bought the Goodyear Rubber Company plant at Providence, and will probably be ready to go ahead with business in about ten days. Some of the most wealthy and prominent men in New England are connected with this company, which manufactures under the patents of Russell A. Dennison. G. D. Haynes & Co., of Boston, will probably handle their product in the East.

Hartford.—A company proposes to build a dam across the Farmington River at Tariffville, put in dynamos, etc., and generate electricity, which is to be conveyed by large copper rods, strung above ground, to Hartford, 11 miles away. About 2,000 horse power will be turned into electrical energy. The Hartford Electric Light Company has agreed to use a portion of this energy, enough, in fact, to supply its patrons and light the streets. The surplus power will be used for electric motors in factories and elsewhere. The contract with the Electric Light Company is so drawn that the power company is sure of a good return for its investment. The names of the promoters of the scheme have not been made public. Work on the proposed dam will begin at once.

The New Exchange Building, now in course of construction on State street, Boston, is to be fitted throughout with a complete system of incandescent lighting. This is one of the largest office buildings in the country, and the occupants will depend entirely upon electric light for artificial illumination, as no gas is to be introduced into the building. The contract for the wiring and appurtenances has recently been awarded to the New England Wiring and Construction Company, of Boston, the oldest house in this line of business in New England. The interior conduit system will be used for wiring throughout, and all of the latest and best methods in this class of work will be persued in this building. Many features new to incandescent wiring will be introduced, and it is intended to make this one of the most complete plants in the country. This is the largest contract for work of this character that has ever been awarded in New England, and the largest, with two or three exceptions, in the country. The building will be wired for about 5,000 16-c. p. lamps. L. H. H.

PHILADELPHIA NOTES.

Branch Office of The Electrical World,
31 City Trust Building. Philadelphia, April 16, 1890.

The local Brush Company are restringing part of Market street with new wire.

Mr. E. Ward Wilkins, of the firm of Partrick & Carter, is now making his annual visit to the West and Southwest.

The Cleverly Electrical Works, 1018 Chestnut street, are very busy on some large orders from the West for their special gas lighting apparatus and experimental work.

Philadelphia.—The Bell Telephone Company has granted the request of its subscribers that rebates, covering periods when instruments are out of order, be deducted from their monthly bills.

Pittsburg.—A company with a capital stock of $500,000 has been organized to manufacture electric mining machines under the invention of M. A. Michaeles, of Pittsburgh, and Dr. O. S. Weddell, of McKeesport, Pa. It is probable that the plant of the new company will be located at McKeesport, Pa.

The Levens Electric Company have secured the contract for electric work at the Park Hotel, Hot Springs, Ark. This will include a 300-number Partrick & Carter annunciator, with fire alarm and guest call. A feature of this system will be the new Partrick & Carter combination bell and push in every room.

Among the Philadelphians who were successful at the Patent Office last week were Cornelius J. Hamilton, an electric snap switch; Rudolph M. Hunter, an electrically propelled car; Frederick A. La Roche, a brush-holder for dynamo-electric machines or motors; and James F. McLaughlin, a secondary battery and a secondary battery electrode.

The South Pennsylvania Railroad was reorganized on April 17. Mr. Geo. F. Baer, of Reading, was elected president; directors, Francis L Stetson, Francis S. Bangs and Chas. MacVeagh, of New York; Jas. M. Mohr, of Philadelphia; Jefferson Snyder and Frank C Smith, of Reading. The other officers will be elected at the first meeting of the directors. The general office will be in Philadelphia.

Mr. Paiste reports that he is doing a large trade in his porcelain pendant cut-out and rosette. His factory for some time has been crowded with orders from supply houses throughout the country. This cut-out is considered one of the neatest on the market. Cut-outs that are made of porcelain are usually disfigured by having the screw that holds the brass parts inside the cap appear on the outside. By an ingenious arrangement this has now entirely been done away with.

His Crowning Discovery.—Thursday of last week, April 17, was the centennial anniversary of the death of Benjamin Franklin. The occasion was appropriately commemorated by the American Philosophical Society of Philadelphia, which was founded by this eminent pioneer electrician in 1740. Among the addresses delivered during the evening, that of Prof. Holland, of the Jefferson Medical College, was particularly interesting. Franklin's scientific work, he said, was contracted within no special line. His ideas were all practical. He was the first man who understood the relation to health of ventilation and equal temperature in houses. Connected with his writings on these subjects were his inventions in regard to chimneys and stoves. His bifocal lens, like his smokeless stove, remains to-day an invention upon which no theoretical improvement has been made. He was the first man who undertook to chart the currents and winds of the ocean, and to show how they might serve, and not hinder, navigation. He first suggested the idea of air-tight compartments in naval architecture, to which the passengers of the "City of Paris" so lately owed their lives. His analysis of the northwest storm was the beginning of the science by which the Signal Office foretells the weather. "All these discoveries," added Professor Holland, in conclusion, "were of small significance when compared with the proofs he adduced that the spark created by friction differs only in its intensity from the thunderbolt forged in the clouds."

WASHINGTON NOTES.

The Simplex Caoutchouc Insulated Wire is very highly recommended and is being adopted by architects and builders of this city in preparing their specifications.

Several cars for the Georgetown & Tenleytown electric street railway have arrived. Work on the road is being pushed forward as rapidly as possible, and it will soon be in active operation.

The Navy Yard at Washington is the first to be lighted by electricity. The plant consists of two 50-lamp Brush machines, and the current was turned on for the first time last Thursday evening.

The Corcoran Art Gallery has recently been supplied with electric lights by the U. S. Electric Company. It was open to the public at night for the first time on Tuesday last, and was crowded to its utmost capacity.

The Bureau of Equipment and Recruitings.—The electrical experts are now away on an inspection tour, and will visit Lynn, Mass.; Schenectady, New York, Brooklyn, Philadelphia and Chester, and will inspect the new plant at the Navy Yard in Washington.

Quite a Novelty is being exhibited on Pennsylvania Ave. in the shape of an electrically operated shoe-blacking brush, run by a C. & C. motor, ¼ h. p. The owner appears to be doing a rushing business in his line, the novelty of the idea and apparatus keeping him busy attending to customers.

At the Lincoln Hall Opera House the electric light installation was completed recently and is said to be the finest of its kind in the United States. Mr. Jno. R. Galloway was the contractor, and the work was superintended by Mr. C. W. Mesner. The plant consists of 400.16 c. p. lamps, supplied from the lines of the U. S. Electric Light Co.

One of the pretty Easter attractions this year was the show window of Messrs. J. H. Small & Sons. The window was decorated with flowers, and in the centre was a cross made of evergreen; supporting a large crown of immortels were 30 small 6-c. p. incandescent lamps. The effect was marvelous. The lamps were supplied from the wires of the U. S. Light Company's lines. Mr. C. W. Messner made the installment.

The United States Electric Light Company, through counsel, have applied to the courts of the District of Columbia for a writ of mandamus to compel the Commissioner of Patents to furnish a certified copy of an application for a patent made by Thos. A. Edison, which is desired by the company as evidence in a suit in which it is involved. Judge Montgomery, formerly commissioner of patents, directed the usual rule to issue for the Commissioner of Patents to show cause why a mandamus should not issue.

Commodore N. H. Farquhar, Chief of the Bureau of Yards and Docks, has recently returned from a tour of inspection of the various electrical establishments of the country, with a view to ascertaining the facilities for supplying several navy yards with electric lights. The advertisement for lighting the New York Navy Yard was withdrawn recently, but plans and specifications are now being prepared in the navy department, and will be advertised soon for bids for lighting the New York yard, the Norfolk yard, and the Mare Island yard, at San Francisco.

The Hotel Normandie will soon be lighted entirely with electricity. The plant, consisting of one 600-light and one 300-light direct current machines, is furnished by the National Electric Manufacturing Company, of Eau Claire, Wis. The Schaefer 100 volt, 16-c. p. lamp will be used. The installation is being made by Mr. L. N. Cox, formerly with the Schuyler Company. The machines will be run by two Beck engines, and it is expected that the plant will be ready by May 1. Mr. Cox also reports the installation, recently, of a 250-light plant in the machine shops of Messrs. Dietrick & Harvey, of Baltimore, Md., for the same company. S. E. D.

WESTERN NOTES.

Branch Office of The Electrical World,
465 The Rookery, Chicago, April 12, 1890.

Racine, Wis., will shortly have an electric street railway.

Lansing, Mich., Parties will invest $40,000 in an overhead railway system.

The Pueblo Gas Company are adding two 650-light Thomson-Houston alternating dynamos to their arc plant.

Mr. F. A. Blades, president of the Detroit Motor Company, Detroit, was a visitor in Chicago for an hour or so last week.

The Kansas City & Blue Valley Railway Company's electric system will be built by Mr. W. B. Knight, of Kansas City.

The Fairmont Electric Light and Power Company, Charleston, W. Va., has been incorporated with a capital stock of $50,000.

The Citizens' Traction Company, Pittsburgh, Pa., propose to build an electric road from the Butler street terminus to Sharpsburg.

Waupaca, Wis., is lamenting her perfect electric illumination, which is temporarily shut off, owing to the loss of water by the breaking of the big dam.

The Rio Grande & Eagle Pass Railroad Company will adopt a system of electric machinery for use in their extensive coal mines above Laredo, Texas.

T. W. Wilmarth Company, at Chicago, to furnish gas and electric light fixtures; capital stock, $75,000; incorporators, T. W. Wilmarth, J. O. Claghorn, and W. W. Johnson.

The Wisconsin Telephone Company, Milwaukee, will connect all small mining towns in the iron range to the exchanges at Hurley and Ashland, Wis., this summer.

Camden, Ark.—Mr. C. A. Ross, Kansas City, has just sold a 650-light Thomson-Houston alternating incandescent dynamo complete to the Camden Electric Light and Power Company,

Incorporations.—Automatic Electric Exchange Company, at East St. Louis, to manufacture electric apparatus; capital stock, $100,000; incorporators, W. H. Ford, A. Leslie and H Overstolz.

Chicago, Ill.—Mr. M. D. Law, late of Philadelphia, called on some of his friends in Chicago on Friday last while en route to Denver, Colo., where he enters on his new and important position.

The East End Electric Company, Pittsburgh, will probably build a power house at Glenwood and one at Sharpsburg, and light both these suburban towns, and also Hazlewood and Homestead.

Mr. Ernest Hoefer, of Chicago, has just returned from a somewhat extended and very successful business trip, during which he disposed of a large quantity of Bishop's gutta-percha white core wires.

Mr. G. A. E. Kohler, late with the Montague Saw Company, has secured the Chicago agency of the Eddy Motor Company, and will open a handsome office on the ground floor of the Pullman Building, Chicago.

Chicago, Ill.—The Electrical Supply Company are placing on the market an incandescent switch fitted with either porcelain or wood base. Also porcelain fusible cut-outs made in all sizes and of the highest quality and finish.

The Hill Clutch Works, of Cleveland, O., will remove their Chicago office on May 1 from its present location on South Canal street to Room 333, The Rookery, Mr. S. S. Leonard remaining in charge of their Western business.

Seattle.—The West Street & North End Electric Railroad Company has let the contract to the Thompson-Houston Company for the electric plant, including cars, engines, boilers, etc. The contract price is reported to be about $110,000.

The Oakland, Cal., Electric Construction Company has been incorporated for the purpose of conducting a general electric business in Oakland. The directors are: Thomas Trebell, J. J. Scofield, A. Humphrey, W. B. Reynolds and J. H. Smith.

Detroit, Mich.—The Detroit Electric Manufacturing Company is the name of a new organization that owns several patents on electrical apparatus, and will erect works for their manufacture and general electrical supplies. Capital stock, $350,000

The Rockford Electric Manufacturing Company, Rockford, Ill., has placed two Mayo motors in Blomgren Bros.' extensiveelectrotyping establishment, that are giving perfect satisfactionand easily drive all the machinery in the place.

Mr. Virgil H. Hewes, formerly at Rensselaer Polytechnic Institute, class '81, passed through Chicago this week, en route to Ironwood, Mich., to engage in the installation of an electric plant of the Thomson-Houston system in one of the mines in that section.

The Northwest Thomson-Houston Electric Company have opened a branch office at 5 Washington Street, Portland, Ore., Mr. H. W. Turner, formerly in the St. Paul office, being in charge, with Mr. F. H. Osgood as manager of the railway department.

The Pueblo Light, Heat and Power Company received another Schuyler arc dynamo April 10, making the fourth increase within 90 days. The arc plant was installed less than six months ago. The same company operate 3,000 Westinghouse incandescent lights.

The Sprague Electric Equipment Company, Chicago, has issued an illustrated catalogue, descriptive of all the material to equip and maintain systems of electric railways, including everything from poles to wire track brooms and from car connecting plugs to axle gears.

The Pullman Palace Car Company, Chicago, will hereafter use the system of interior electrical conduits in all the sleeping and passenger coaches and in street railway cars wired by them, having arranged with the Electrical Supply Company, Chicago, for the necessary materials.

Mr. J. H. J. Shultz, president of the Shultz Belting Company, of St. Louis, was in New York on Monday. He was accompanied by Mr. W. P. Mullen, of Boston, vice-president of the company. The Shultz belting seems to be as popular as ever with electric light and power companies.

San Francisco, Cal.—Articles of incorporation have been, filed by the Electric Street and Station Indicator Company. The capital stock is $500 000, of which $420,000 has been subscribed. The directors are John L. Cahill, Lucius H. Foote, Alexander G. Hawes, Joseph D. Grant and Reuben Lloyd.

Mr. B. E. Davis, Secretary of the Standard Electrical Works Cincinnati, has just returned home after a very successful Northern trip. Among the late sales made by the company were nine miles of O O B. & S. gauge, special make, of Candee street railway wire, and about 12 miles of trolley wire.

The Chicago Board of Trade threatens to establish its own lines of wire should the Western Union Company persist in demanding the increased rates put in force April 1. The Board would build lines connecting it with New York, Toledo, Buffalo and Albany, and perhaps with Boston and Philadelphia.

Mr. George Cutter, of Chicago, has met with unusual success in the introduction of his tin shade for incandescent lamps, having sold many thousand shades. And it is worthy of note that these shades have been so well made and have given such excellent satisfaction that in many cases orders have been duplicated.

The Growth of Electric Lighting.—Some idea of the wonderful growth of the electric lighting industry can be gained from the books in the Chicago office of the Thomson-Houston Electric Company, which show that on Jan. 1, 1890, there were in operation from central stations alone 68,203 arc lights, 144,050 direct current incandescent lights, and 208,700 alternating current lights.

The Charles Munson Belting Company, Chicago, have just secured through their New Orleans agency an extensive order for leather belting that runs out of mere units into miles, namely, over two and a half miles of two-inch belting and over two miles of larger sizes. The company has had to secure additional floor space, and extend their factory to take in numbers 22 to 36, inclusive, South Canal street.

The National Board of Underwriters, Chicago, has established an experimental room on Monroe street for thoroughly testing the various types of electrical apparatus, motors, interior conduits, etc., offered by the trade, with a view to determine the possibility of danger from fire, etc. To drive the necessary shafting required, the board has contracted with W. S. Armour to install a Detroit motor.

Chicago, Ill.—The Buckeye Electric Company, Cleveland, O., have opened an extensive factory at 1,925 to 1,929 Broadway, for the manufacture of incandescent lamps and appliances. The office of the company is located at 15 South Water street, and the following gentlemen comprise the officials: F. H. Prentiss, president; C. H. Rockwell, treasurer; M. A. Lawton, Jr., secretary; and Gustave A. Frei, superintendent.

Prof. Elisha Gray.—The notable society event of the season at Highland Park occurred on Tuesday last at the residence of Prof. Elisha Gray, in the form of a brilliant reception. A canvas-covered frame building had previously been erected on the lawn, where dancing was enjoyed till a late hour. The music and refreshments were furnished by Werner, and a large number of the electrical fraternity participated in the evening's enjoyment.

The Electrical Supply Company, Chicago, is finding ready sale for its "B. W. Ampère Indicator," a compact and simple instrument designed to be kept constantly in circuit and with a scale arranged for any class of work. The instrument is handsomely encased, and considering its accuracy, low in price. The company is furnishing the interior conduit system to the Auditorium building, and to several other large structures in the West.

The Knapp Electrical Works, Chicago, have secured the agency for the Crosby dry battery spoken of so highly by Dr. Schuyler S. Wheeler, for "qualities of simplicity of construction, cleanliness, finish and general adaptability to the work that such batteries have to perform." The demand for the Knapp needle annunciator keeps increasing, and many of the leading supply-houses have the Knapp annunciator placed in a special style of case for their particular trade.

The National Engineering Bureau, Chicago, are meeting with excellent success, having already been called upon to furnish expert service for the inspection of plants in several cases, as well as to furnish drawings and estimates of prospective plants. A feature about to be started is that of furnishing local lighting companies with the names of men capable of filling vacant positions, thus enabling a manager to replace an incompetent man with one of experience without delay.

The Knapp Electrical Works, Chicago, during the past few weeks have kept their employés working overtime to enable customers to receive promptly the goods ordered, and also to dispose of the assorted sizes of wire that has been coming in carload lots. Not only have this company hundreds of miles of Grimshaw white core wires on hand, but also 100 reels of high grade weather proof line wire of superior finish, that can be shipped on telegraphic notice, thus saving much valuable time. One shipment made last week included 20,000 feet of lead-incased Grimshaw cable.

The Central Electric Company, Chicago, are comfortably settled in their handsome quarters and taking all the business they can handle as it comes along. In the matter of line construction material, they have everything in stock requisite for such work, from a Brady mast arm to a Lowell lag screw wrench. They are also running into the literary line, having secured control of "Davis's Wiring Tables," a book of convenient size for the pocket, yet containing a fund of information for the constructing force, touching on every point from the symbols employed by architects to designate electrical apparatus to an illustration of wiring on the three-wire multiple incandescent system.

Telephone Quotations.—Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes quotations on telephone stocks as follows:

Chicago	$290@$295	Cumberland	$ 59@ $60
Central Union	57@ 58	Wisconsin	116@ 117
Michigan	96@ 98	Bell of Missouri	140@ 145
Great Southern	30@ 32	Iowa Union	21@ 23
Colorado	38@ 40	Missouri and Kansas	54@ 55
Rocky Mountain Bell	40@ 45		

ELECTRIC LIGHT STOCKS.

Chicago Arc Light and Power	$95@$98	Chicago Edison Co	$113@$114

Storage Batteries.—The president of one of the street railway companies in a city near Chicago recently said: "We find that there is little traffic on our lines after 10 P. M., but we have to run our cars until 1:30 A. M. To run our steam plant during that time is quite expensive, and, after careful investigation, we have about concluded to place several storage battery cars in use from 10 P. M. to 2 A. M., thus giving the machinery a good rest. The batteries can be charged during the day, while the plant is in operation, and one charging will be ample for the trips required in three night runs. This will also enable us to do away entirely with the use of all horses on the lines except a dozen for use about the stables."

Mr. E. Ward Wilkins, of the firm of Partrick & Carter, Philadelphia, was in Chicago this week calling on his many friends. Referring to business prospects, Mr. Wilkins said that the growth in their line was unprecedented; that five years ago they would hesitate before making up a lot of 1,000 vibrating bells, while now they are carrying a stock of 20,000, and the same increase is noticeable in their annunciator business. He has secured orders in one day on the present trip for 1,650 Leclanche cells of their own make. The company do no construction work, confining themselves strictly to manufacturing for the trade, and to operating through local agents. Among the late contracts secured is one from the Denny Hotel at Seattle, Washington, for a 300-number P. & C. combined hotel annunciator, with return guest call, fire alarm, and also a burglar alarm combination preventing entrance to the room by any one not provided with the Yale circuit closing key. A 350 P. & C. combined annunciator will also be installed in the New Park Hotel at Hot Springs, Ark.

The sales for the Beck automatic engines are reported by the Taylor Manufacturing Company, of Chambersburg, Pa., as on the increase, and among some of the recent orders are the following: one 16 x 18-inch engine with two 66-inch x 16 foot boilers for the Metropolitan Street Railway Company, of Portland, Oregon, operating Sprague motors, making the second complete plant that they have sold for railway service in Portland within the last few months, and the third plant that has gone to Oregon in the same time for operating the same system of electric railway motors; one 14½ x 15-inch engine with complete plant to the Augusta & Sumerville Street Railway Company, of Augusta, Ga., for driving their Thomson-Houston electric generator; one 12½ x 15-inch engine to the Hill City Electric Light Company, Vicksburg, Miss.; two 11½ x 15-inch engines, with boilers, for the Newcastle Electric Light Company, Newcastle, Pa., and two 11 x 12-inch engines for the Muscatine Electric Light and Power Company, Muscatine, Iowa.

Mr. Henry B. Stone has resigned the second vice-presidency of the Chicago, Burlington & Quincy Railway Company, to date from June 1, when he will accept the presidency of both the Chicago Telephone Company and the Central Union Telephone Company. Mr. Stone is a graduate of Harvard and but 35 years of age. His first service was in the Burlington shops, where he passed through the various grades of the mechanical department until he became division master mechanic at Aurora. In 1880 he was appointed superintendent of the locomotive and car department, and in 1881 became general superintendent. Two years later he was made assistant general manager, and then was promoted to general manager. Shortly after, the great strike of the engineers was inaugurated, and too much praise cannot be given to Mr. Stone for the determination and the strength of character shown in that contest, when untold odds were against him; and the victory won was worthy of the man. Following the close of the strike he was elected to his present position. Mr. Norman Williams has been acting as president of both the telephone companies since the death of the lamented George Philips, but other important business matters have compelled him to seek relief.

The Hon. Jesse Spalding, president of the Spalding Lumber Company, Chicago, and member of the Government Board of Directors of the Pacific Railroads, makes the following interesting comments in his report to the Secretary of the Interior: "Tacoma, Washington, has a present population of about 25,000; 1,300 buildings costing about $6,000,000 were erected during 1889, and there are now in course of construction some thirteen miles of electric street railways. Seattle is the largest city in the State of Washington, having a population of not less than 40,000, which is double what it had in 1888. Here there are three cable and three electric street railways and six other lines under construction. Two hundred and seventy-five new firms were established last year. Spokane Falls, Washington, has a population of 20,000, with a three-mile electric railway and a three-mile cable railway, and other roads that will cover about twelve miles either have been constructed or are under way. Its water power is equal to any in the country, and this force is now used to operate the electric plant of the city, the water works, the electric railway system, the cable railway system and all the flour and saw mills of the place." F. DE L.

SOUTHERN NOTES.

NORFOLK, Va., April 16.

The Opelika, Ala., Electric Light Company will erect a new plant.

Roanoke, Va., is discussing the advisability of adopting an electric alarm system.

Carrollton, Ga., has contracted for an electric light system, which will be in operation within six months.

Harriman, Tenn.—The hotel now in course of erection will be wired for 400 lights of the Westinghouse system.

The Clark & Crooks Corn Meal Mill, Memphis, Tenn., employ automatic magnetic separators in their operations.

The City of Winston—Salem, N. C., will soon have in operation a very complete electric light and telephone system.

During the first quarter of the present year twenty electric light works were organized in the Southern States, Georgia leading with ten.

A telephone line is being constructed from Ozeanna, Va., to Richmond, *via* Tappahannock, Walkertown, Dunnsville, West Point, etc.

At Lynchburg, Va., a company is organizing to establish a plant for the manufacture of small machinery, fittings, etc., for electric light lines.

The Coosa River Telephone Company, to extend from Rome, Ga., to Gadoden, Ala., has been sold to the Bell Telephone Company, the price having been $1,200.

Bedford City, Va., will be lighted by electricity in a few months. The contract has just been awarded to the electric light company of that place by the city council.

New Berne, N. C.—The electric light system is completed, and the lights were turned on recently by Miss Bessie Williams, the little daughter of the Mayor. There are 25 arc lights.

Griffin and Carrollton, two growing Georgia towns, are to have an electric connection. A force of hands, under the management of the Georgia Central Railroad, is engaged in setting in the poles.

An electric street railway is to be built between Lynchburg and West Lynchburg, if the City Council will grant the right of way through certain streets. A New York syndicate is organizing the company.

La Grange, Ga.—The city council is negotiating with the electric light company with a view to substituting electricity for the expensive kerosene lamps now used for the alleged purpose of lighting the city.

The Novelty & Electric Company, Memphis, Tenn., have secured the contract from the school board for wiring and tubing four buildings, requiring a total of about four thousand feet of speaking tube.

La Grange, Ga.—During a recent wind storm a piece of tin was blown across the electric wires, damaging the apparatus and shutting off the light. Everything has been properly adjusted, and the lights now work satisfactorily.

Elizabeth City, N. C., Electric Light Company is nearly ready for service; the new engine and boilers are in position, and two new dynamos have been received. Mr. J. R. Coomes, Jr., an expert electrician, has been selected by the company as superintendent.

Portsmouth, Va.—The Citizens' Light, Heat and Power Company has been organized by local, New York and English capitalists. R. M. Stewart Wortley, of England, is president, and W. V. H. Williams, of Portsmouth, secretary and treasurer. The company will begin at once the erection of an electric plant which will cost about $50,000.

In Nashville, Tenn., recently, an electric car caught fire while crossing a bridge. The fire was caused by the breaking of the motor box under the car. The dragging of the sheet iron lid caused the connection with the rails, and the wood work caught fire. The car was damaged to the extent of several hundred dollars. The passengers left the car at the first alarm.

Macon, Ga.—The appartments occupied by the Telephone Company are rented. Since the company has made that city the headquarters for that division, the offices having been moved from Charleston, the company wishes to buy a building for its own use. Negotiations are now pending with this end in view. Macon has become one of the most important telephone points in the South.

Governor McKinney, of Virginia, recently received a petition from a number of State employés, whose offices are in the basement of the Capitol, requesting the removal of the electric wires from the building, on account of the alleged danger of being burned by the wires. The Governor, after a thorough examination of the matter, refused the petition, and ordered the lights to remain. He said he could see no grounds for apprehension whatever.

Fast Sending South.—The operators of New Orleans had a fast sending telegraphic tournament on Sunday last, using the same matter as was transmitted at the Hardman Hall test. In class "A," Mr. W. S. Brewer sent 211 words of "superior" Morse in five minutes, Mr. Mentzer 211 of "good" Morse, and Mr. D. B. Jones 210. In class "B," T. G. Griffin sent 194 words and Mr. J. W. Gordon 187, while in class "C," P. A. Moake sent 182 words. Mr. E. J. Davis was manager of the tournament.

The Longest Private Telephone Line in the South, and among the longest in the country, has just been completed in Alabama. The wealthy iron manufacturer, Mr. De Bardeleben, of Bessemer, is the owner. The line radiates from that gentleman's office in Birmingham to his office in Bessemer, with branches to Edgar, Johns, Sumter, Waring Junction, Eureka Furnace and Oxmore, and thence to the Birmingham Exchange. The line is over thirty miles long and cost the owner more than $5,000.

The Board of Aldermen of Wilmington, N. C., are discussing the advisability of purchasing their fire-alarm system, owned and operated by the Gamewell Fire Alarm Company.

There are, at present, 18 alarm boxes, valued by the company at $6,500, and it is proposed to put in ten others, needed by the city, for $1,200 additional, making the total cost of the plant to the city $7,700. It was shown that the rental is now $775 for the use of the plant, or about ten per cent. its present value. It was proposed that an offer of $7,500 be made to the Gamewell Company, which proposition they now have under advisement.

Richmond, Va.—The annual meeting of the stockholders of the Burton Electric Company, was held recently. Dr. W. Leigh Burton, the inventor of the heater manufactured by this company, and the superintendent, read his report, which showed that the company was making progress, and that the large electric agencies were taking hold of the heater with the most promising results. All the electric railway companies that have given the heater a trial have found it fulfil its claims so well that a second supply has, in every instance, been ordered. Letters were read from some of the largest railroad corporations in the country, intimating that they would soon test this heater. The following directors were elected: C. E. Wings, Charles R. Skinker, Dr. Jno. Mahoney, J. Taylor Ellyson, R. B. Lee, Wm. Simpkin, John Chamblin, W. P. De Saussure.

The City & Suburban Railway Company, of Memphis, Tenn., of which Mr. Holmes Cummins is president, Thomas F. Duffin, vice-president, and John L. Norton, secretary and treasurer, has purchased the Prospect Park dummy line, and will make several changes in the route, power, cars, etc , as soon as the work can be done. By this purchase ten miles of track, with valuable parks, depot grounds, etc., have been added to the property of the company. This company will use the Thomson-Houston overhead system, all of which has been ordered. A part of the material is now on its way there. The cars are to be furnished by the St. Charles Car Company, and contracts have been let for the work, to be completed and the cars running to Magnolia Station, a distance of seven miles, by June 1. The company has also purchased the Jackson Mound Park, the old camp ground of General Jackson, one of the most beautiful locations for a pleasure resort in the South. As soon as the changes in the main line are completed, a branch from Rayburn avenue to this park, a distance of about two miles, will be constructed. V. N. B.

ENGLISH NOTES.

(From Our Own Correspondent.)

London, April 9, 1890.

Postal Telegraph Revenue.—The postal telegraph revenue returns for the financial year ending March 31 show a gratifying increase. The receipts from the telegraph service amounted to £2,320,000, an increase of £240,000 over the receipts of the preceding financial year.

London Subways and Overhead Wires Bill.—This bill, which was put forward by the London County Council, and had for its object the construction of a regular system of subways in the metropolis and the granting to the county council of wide powers in connection with the regulation of overhead wires, has been partially abandoned, in face of the uncompromising opposition with which it was threatened on all hands. The bill will, however, be proceeded with, so far as it relates to overhead wires.

The Langhan Incandescent Lamp.—This lamp, which is now being introduced into this country, is chiefly noticeable on account of the low vacuum and the employment of a metallic filament coated with silicum. It is said that the life of the Langhan filament at 2.75 Watts per candle power is equal to that of the best carbon make, and that ordinary carbon filaments can be coated with silicum by the Langhan process, and they then require less current to give the same amount of light and can be made to work in a vacuum corresponding to about one millimetre.

The Costliness of Cheap Wiring.—The first authenticated case in this country of a death arising from a shock received from an electric light wire occurred at Brighton some months ago. The offending company (the Brighton & Hove Electric Light Company) have just had to pay $4,000 damages to the widow of the man who met his death. The wire was conveying an alternating current at a pressure of 2,000 volts, and was strung in a careless manner across the roof of a brewery, on which men were frequently at work.

Magnet Steel.—In the course of some remarks recently made at the Institution of Electrical Engineers, Mr. W. St. Preece stated that the post-office authorities had observed of late a great deterioration in the quality of the magnet steel supplied to the post-office. A few years ago, Mr. Preece said, steel could be had that would permanently retain an induction of 5,000 C. G. S. units, whereas latterly the highest permanent induction was only 3,700. It is interesting to note in this connection that Prof. Perry testifies to the fact that some hard steel recently supplied to him by a Sheffield firm showed a permanent induction of no less than 12,600 units.

Electric Welding.—Electric welding, like electric traction, does not make much headway in England, and we still remain in the demonstration stage. Last week several of the managers of the South Staffordshire Iron and Steel works paid a visit to the Birmingham Compressed Air Company's Works to witness some experiments in electric welding, and the visitors went away greatly impressed with the possibilities of the process. Next week Sir Frederick Bramwell, F. R. S., is to give two lectures on this subject, the first at the Institution of Civil Engineers and the second at the Royal Institution. I also hear that the electrical welding syndicate, which is pushing the process in England, is about to transform itself into a company with a capital of £400,000.

Agitation Among Telegraph Operators.—The dissatisfaction that has for some time past been rife among the employés in the telegraph service culminated recently in the formation of a Postal Telegraph Clerks' Association. The chief grievances of these public servants are insufficiency of pay, overwork, and stagnation of promotion. Another grievance is the deduction of pay during sickness, which certainly seems somewhat hard when we remember the unhealthy conditions under which most of the telegraph work is done in this country. As an instance of the vast amount of work that has to be dealt with, it may be interesting to note that on the night that Mr. Gladstone introduced his Home Rule Bill no fewer than a million and a half words were flashed from the Central Telegraph Office in London. Owing to the lack of encouragement, so dissatisfied are many telegraph operators with their present position and future prospects that of late large numbers have left the service and gone out to the colonies. Up to the present the agitation has not had much effect in improving the position of the operators, but it is hoped that the Treasury will see their way to make timely concessions. After the Easter recess the question is to be discussed in the House of Commons.

Electric Traction.—Dr. Louis Bell's recent paper on "Electric Motors for General Railway Work" has attracted considerable notice in this country. Our most influential financial daily paper, the *Financial News*, devoted a leader (evidently inspired by some one with technical knowledge) to the discussion of this paper. This week Mr. W. Graff Baker, general manager of the railway department of the Thomson-Houston International Electric Company, sends to the same journal a long letter on the subject of electric railway business in this country. Mr. Graff Baker has now been in England for nearly twelve months, but although he came over with the intention of doing something startling in regard to electric traction, it does not appear that he has yet realized his sanguine anticipations. In fact, his letter is mainly devoted to re-telling the story of what has been accomplished in the States. As to this country, all we are told is that "a company is in the process of formation which will materially assist in the introduction of electricity in the place of steam as well as horses.'

Deptford Central Station.—The statements made by the chairman (Mr. J. S. Forbes) and the report of the engineer (Mr. S. Z. de Ferranti) at a meeting of the shareholders of the London Electric Supply Corporation, last week, reveal a somewhat serious state of things in connection with the colossal central station at Deptford. Work has now been going on at this station for over two years. More than £100,000 has been spent in buildings, over £68,000 in plant and machinery, and over £44,000 in mains; the total expenditure for the two years amounting in all to £505,000; and all that the chairman and engineer were able to report at the meeting in question was that two 30,000-light dynamos were in operation, but owing to the failure of the temporary trunk mains to London even these were working at only one-fourth of their normal voltage (10,000 volts). Even making allowances that the chairman rightly stated should be made for "the risky and speculative nature of the scheme," it must be confessed that so poor a result after so much labor and expenditure is most disheartening. It is now evident that the erection of a colossal generating station, the management of such high pressure, and the use of such abnormally large dynamos, has not proved (as was indeed predicted by many) the simple matter that the corporation's engineer anticipated. Early in the autumn it is proposed also to move the entire plant at present at the Grosvenor Gallery to Deptford, where there will then be a capacity of about 60 000 lights. By the beginning of next year, Mr. Ferranti hopes to have his two 200,000 light dynamos in operation, but at first only working at half their maximum output. So that in a year's time, if no further defects crop up, this station will have a capacity of a quarter of a million lights. As yet none of the Ferranti mains have been laid; but this will be done in the course of the present year. It is reported that this main has been tested up to 30,000 volts and shown no signs of failure; but of that we shall speak more confidently when a test has been had at 10,000 volts, under working conditions. Altogether this state of affairs can scarcely be said to be encouraging, and electrical engineers in this country will feel relieved when they see Mr. Ferranti well out of his difficulties.

THE ELECTRIC LIGHT.

Rusk, Tex.—$5,000 bonds have been issued for electric lighting.

Rockville, Md.—An electric light company is being organized.

Washington, Ga.—An electric light plant is to be introduced.

Vernon, Tex.—A company has been formed for electric lighting.

Brunswick, Ga.—Will double the capacity of its electric light plant.

Rock Hill, S. C.—It is stated that an electric light plant will be started.

Millbury, Mass.—Portions of the town are to be lighted by electricity.

Sleepy Eye, Minn., is about to close a contract for a thirty-arc light machine.

Spring City, Tenn.—It is reported that an electric light plant will be erected.

Orono, Me.—Efforts are being made to establish an electric lighting plant.

Spencer, Ia.—Arrangements are being made to supply an electric light plant.

Millvale, Pa.—An electric light company has been established with a capital of $10,000.

Harrisburg, Pa.—An electric light company has been organized with $10,000 capital.

Russellville, Ky.—A company is reported as being formed to erect an electric light plant.

The Pueblo Opera House Company are installing an Edison isolated plant of 1,800 lights.

Leavenworth, Kan.—An electric light company has been formed with a capital of $100,000.

Galveston, Tex.—The Galveston Land Improvement Company will put in an electric light plant.

Covington, Ky.—The Homesdale Lot Company contemplate putting in an electric light plant.

Logan, O.—The Logan Electric Company, has been incorporated with a capital stock of $15,000.

Newport, Ark.—L. Hirsch intends to purchase a 650-light light plant, and also a 50-arc-light dynamo.

Grafton, W. Va.—A company, with $100,000,capital has been formed to light the town by electricity.

Goldsboro, N. C.—A gas plant will be required at the Insane Asylum. Dr. J. Miller can give information.

River Point, R. I.—The River Point Electric Light Company has been organized with a capital stock of $30,000.

Atlanta, Ga.—The Thomson-Houston Light Company is about adding a 1,000-incandescent light dynamo to its plant.

Letonia, O.—Letonia Electric Light and Power Company; increase of capital stock from $10,000 to $15,000.

Fairfield, Ia.—The Fairfield Gas and Electric Light Company has been incorporated, with a capital stock of $50,000.

Woonsocket, R. I.—The River Point Electric Light Company has been organized with a capital stock of $30,000.

Denver, Colo.—The City Council has decided against the advisability of the city building an electric lighting plant for it own use.

The St. Louis Electric Light Power Company, of St. Louis, has filed a statement of increase of capital stock from $8,000 to $30,000.

The Thomson-Houston Company is to erect a plant at Napa, Cal., and to install an incandescent lighting plant at Fort Wayne, Tex.

Leavenworth, Kan.—A company to be known as the Leavenworth Electric Light Company has been formed in that city. The capital is $100,000.

Belton, Tex.—D. A. Chamberlin, M. V. Smith and L Bryan have incorporated the Belton Electric Light Company with a capital stock of $200,000.

Chattanooga, Tenn.—The Ridgedale Electric Light and Power Company has been incorporated by J. S. O'Neal, C. A. Lyerly and S. W. Divine.

Rockville, Conn.—The Rockville Electric Light Company will be formed here, and will put up a plant with a capacity of 40 arc and 500 incandescent lights.

Seattle, Wash.—A syndicate has been granted a franchise to put in a $50,000 electric light plant, with a capacity of 5,000 lights. Dr. E. C. Kilburne can furnish information.

Fargo, N. D.—The contract for lighting the town has been awarded to the Fargo Gas and Electric Company. Twenty arc-lights will be put in at once by this company.

Decatur, Ill.—The Mount Pulaski Electric Company to furnish light, heat and power; capital stock, $6,000; incorporators, C. J. Parke, N. H. Parke and W. B. Chambers.

Durango, Tex.—The Durango Electric Light Company has been incorporated with a capital stock of $150,000. Incorporators: Theodore Plate, John Plate and Albert Schenk.

Chicago.—The Illinois Electric Service Company, to operate electric light and power plants; capital stock, $2,000,000; incorporators, G. E. Spear, A. W. Reese and A. J. Price.

Omaha, Neb.—The incorporation is announced of the new electric light company. Its capital stock is $600,000, and the incorporators include S. L. Wiley and Frank Warren.

Washington, D. C.—The Columbia Electric Light Company is being organized with a capital of $250,000, by James S. Humbird, P. Foley, Lewis Clephane, C. C. Lancaster and others.

The City Council of Eugene, Ore., has contracted with the electric light company of that city for arc lights for street lighting purposes, instead of the present incandescent lights.

New Westminster, B. C.—The New Westminster Electric Light and Motor Power Company, will be incorporated with a capital stock of $100,000, for purposes indicated by the name.

Chattanooga, Tenn.—The Ridgedale Electric Light and Power Company has been incorporated to erect electric light plants. J. S. O'Neal, C. A. Lyerly, and S. W. Divine, incorporators.

Highland Park, Ill.—The Highland Park Electric Light Company has been incorporated with a capital stock of $25,000. Incorporators: B. E. Sunny, H. H. Small, and B. H. Anderson.

The Falmouth, Ky., Electric Light and Motive Power Company has been incorporated with a capital of $30,000, by J. C. Hamilton, J. W. Thompson and J. M. Rizzle.

The Morrison, Ill., Electric Light Company has been incorporated with a capital of $25,000 by Ed. A. Smith, O. H. Brown, and J. H. Brown, and will furnish light, heat and power.

Asheville, N. C.—The Asheville Electric Light Company has decided to double its plant. The addition to be made will be the Edison 3-wire system, and the total capacity will be 720 lights of 16 c. p.

New Auburn, Me.—The Lewiston and Auburn Electric Light Company have purchased of the Westinghouse Company a 1,500 incandescent-light dynamo, which they will put in their plant in this city.

Independence, Mo.—The Citizens' Electric Light Company has been incorporated, with a capital stock of $25,000. Incorporators, I. N. Rodgers, W. A. Cunningham, W. S. McCoy and Chas. Gudgell.

Ilion, N. Y.—The Horns Electric Light Company has been incorporated, with a capital stock of $15,000. Incorporators, William F. Bossert, Sanford Getman, A. A. Morgan, S. W. Skinner, G. W. Robinson.

Articles of Incorporation have been filed with the Secretary of State by the Fairfield Gas and Electric Company, Des Moines, Ia., with a capital stock of $50,000, and to be governed by a board of directors.

Lowell, Mass.—The largest electric light plant in a New Eng and mill is that in the buildings of the Lowell Manufacturing Company. This plant, with its recent additions, has a capacity of 2,806 lights.

Falmouth, Ky.—The Falmouth Electric Light and Motive Power Company has been incorporated, with a capital stock of $30,000; J. C. Hamilton, J. W. Thompson, J. N. Riggle and others, incorporators.

Morrison, Ill.—The Morrison Electric Light Company has been incorporated with a capital stock of $25,000, to furnish light, heat, and power. Incorporators: E. A. Smith. O. H. Brown, and G. H. Brown.

Collinsville, Ill.—The Collinsville Electric Light, Heat and Power Company, to furnish electric light, heat and power: capital stock, $25,000; incorporators, Louis Lumaghi, George Hadfield, and T. J. Thomas.

The Ocala, Fla., Light and Power Company has been incorporated with a capital of $25,000, to erect an electric light plant. The incorporators are J. F. Dunn, James Chambers, R. B. McConnell and others.

Windsor, N. S.—The Windsor Electric Light and Power Company has been organized, with the following board of directors: A. Forsyth, president; J. Doran, P. J. Mosher, H. Y. Hind, J. B. Black, M. D., Rufus Curry.

The Westinghouse Company report the sale of a 1,000-light 2000-volt, special type, alternating machine to the Brookline Gas and Electric Company. This machine is to be used for incandescent lighting at long distances.

Tuscaloosa, Ala.—The Tuskaloosa Gas, Electric Light and Power Company has been incorporated with G. A. Searcy, president; J. A. Daniel, secretary and treasurer. It has purchased and will operate the Tuskaloosa electric light plant.

Warrensburg, Mo —The Warrensburg Electric Company, has been incorporated with a capital stock of $25,000, to generate and sell electricity for light, heat and power. Incorporators: James H. Christopher, James D. Eads and Geo. B Shaw,

East St. Louis, Ill.—The Aguas-Calientes Electric Company, has been incorporated with a capital stock of $150,000, to carry on electric light and power works at Aguas-Calientes, Mex. Theodore Plate, John Plate and Albert Schenk, are incorporators.

Easton, Pa.—The City Council, has passed ordinances and awarded contracts to the amount of $16,000 for enlarging the city's electric light plant. The capacity of the plant will be 175 arc lamps, with two engines, each sufficient to drive the dynamos.

Arkansas City, Kan.—The National Electric Light & Power Company has been incorporated; capital stock, $50,000. Directors: W. A. Thomas and J. F. Saunders, of Guthrie, Oklahoma, and M. F. Bailey, Charles Hutchins and E. L. McDowell, of Arkansas City.

The Kakabeka Falls Land and Electric Light Company, Limited, Toronto, Ont.; capital stock, $800,000, in $100 shares

The promoters are: A. P. Boller, New York; E. D. Smith, Alexander McGan, E. V. Douglass, Philadelphia; W. P. Douglas, Minneapolis.

The Bucksport (Maine) Electric Company has been organized at Bucksport with the following officers: President, John Post, Jr.; Vice-President and General Manager, F. S. Palmer; Treasurer, Otis K. Smart. The company intends to erect a 1,000 light incandescent.

Peterboro, Ont.—The Brooks Manufacturing Company is the first that has been organized in Canada for the manufacture of electric light carbons. They announce that they will manufacture nothing but the very best quality of goods, and that they will be ready to fill orders promptly.

Salt Lake City, headquarters of the Latter Day Saints, is to have a lighting plant to use the Westinghouse alternating current incandescent system. The initial capacity of the plant will be 500 lights only, but the prospects are good for an increase at an early date after getting the apparatus at work.

Delaware, O.—An electric light and power company has been organized with a capital of $60,000, divided into $500 and $100 shares. The shares have all been taken, and the incorporators are all men of financial standing, and include Wm. S. Parks, Leopold H. Hartzmiller, Carey B. Paul, Jacob G. Rosenthal and Martin Miller.

At North Adams, Mass., the electric light company has just closed a contract with the fire district to light the town. The company will put in 45 lights, an increase of 32 over the present number. The lights are to burn every night in the year, and will be located to the best possible advantage. The 13 lights put up last year have given great satisfaction.

Pella, Ia.—The Electric Light and Power Company is preparing to add another dynamo to their already finely equipped plant. At present there are 600 incandescent lights in active operation in the residences, business houses, and streets. There is also strong talk among a few of the thirteen church congregations of illuminating their places of worship with electricity.

Baltimore, Md.—The Woodberry and Belt Electric Light and Power Company has been incorporated by James E. Hooper, Francis E. Waters, W. Irving Walker, George Poole and Henry Huttan, all of the city of Baltimore, Md. Its object is to supply electricity for illuminating purposes and all other uses to which electricity may be applied. The capital stock is $100,000, with privilege of increasing it to $1,000,000.

The Rochester Electric Company, of Rochester, N. Y., previously noted in these columns as incorporated, with a capital of $12,000, has organized and elected the following officers: President, H. C. Fry; Secretary and Treasurer, W. S. Shallenburger; Manager, O. B. Shallenburger. A plant will be erected at once, and is expected to be in operation by May 15. The Westinghouse incandescent system will be adopted. The company will also light the towns of Bridgewater and Beaver.

The Westinghouse Electric Company is negotiating for the purchase of the Brush electric light plant in Baltimore. To secure a controlling interest, the Westinghouse Company guarantee 5 per cent. on $200,000 of bonds, and 6 per cent. on $600,000 of stock. The Brush Company will issue $1,000,000 of common stock. Of this the Westinghouse Company will purchase $250,000 for cash, and the remainder will be placed on the market, and receive the dividends paid by the business.

The Wood System of arc lighting, manufactured by the Fort Wayne Electric Company, has placed machinery for no less than 5,750 lamps since October, 1889, when the first order was received. To St. Louis have gone 2,400 lamps, to Detroit 1,060, and to Cincinnati 500; while other orders have been filled in San Francisco, Chicago, New Orleans, and, in fact, throughout the country. The New York agent, Mr. H. C. Adams, 115 Broadway, states that every customer has been glad to recommend the system to all inquirers.

Providence, R. I.—The Armington & Sims Engine Company have received orders from the Thomson-Houston Company, of Boston, for the machines to be used in lighting the new cruiser Newark. There are to be three double upright 7 × 5 engines, strictly of the marine type, to give the greatest amount of power for the least possible floor space and weight. They will not be compounds, recent exhaustive experiments in the French and British navy departments having demonstrated that small compound engines are not advantageous in ship-lighting. The contract was, therefore, awarded in a measure on the basis of the experience abroad.

APPLICATIONS OF POWER.

Topeka, Kan.—The Electric Rapid Transit Company, empowered to do business at Topeka and at Los Angeles, Cal., has been incorporated; capital stock, $500,000.

Springfield, Mo.—A company with a capital of $150,000 is being organized for the purpose of buying up the existing street railways and equipping them with electricity.

Logansport, Ind.—A company with a capital stock of $25,000 is being organized to manufacture the Wooley electric motor. H. B. Pullman isthe inventor of the machine.

St. Louis, Mo.—Crosstown Electric Railway Company; capital stock, $100,000, half paid up, has been incorporated by G. Campbell, E. D. Meier, D. K. Ferguson, D. W. Brown, P. K. Marion and C. C. Carroll.

A charter has been granted to the Lancaster & Lititz electric railway. The capital is $50,000. The road will be run from Lancaster to Lititz, Pa., and will be operated by the same company that controls all the Lancaster City street railways.

Electricity Instead of Horses.—It is understood that the Brooklyn City Railroad Company will change the motive power on their Third avenue line to electricity very shortly. A franchise for the extension of their road will probably be issued immediately.

The Baxter Electric Motor Company, of Baltimore, has just shipped to the Austin Water, Light and Power Company, Austin, Tex., two 1 h. p. motors, and is in receipt of orders and inquiries from Buffalo, N. Y., for fourteen 2 h. p. 100-volt constant potential motors.

Albany, N. Y.—The electric cars are not to be run on the Broadway line, until the Supreme Court settles the controversy between the street car company and the telephone company. The street car company could run its cars by putting up a bond of $50,000, but this it refuses to do.

Inventors in Detroit claim to have perfected a storage battery motor. One of the interested parties says: "The motors will cost about $1,800 each. A motor with a street car body is worth about $2,500 to $3,500. To run a day will cost for charging the batteries from 25 cents to $1.25, according to the length of the run. Our batteries represent 300 ampères each charge. I do not see how the overhead or underground systems can compete with the storage battery system. We need no special equipment. We do not burden the eyesight with the overhead system, nor the street with the underground conduits."

Augusta, Ga.—A large contract recently made by the Sprague Company is that with the Augusta Street Railway. The equipment of the road, which will be in operation before very long, will be first-class in every respect. The cars to be equipped with electric motors are 16 in number, and each will carry two 15-h. p. motors. At the station the generating plant will consist of two 80,000 watt dynamos for supplying the necessary current for the line. The route will be more than 15 miles in length, passing the Union station, opera house and principle points of interest in the middle of the city. It is hoped that five cars will be in operation by May 15, and the rest of the equipment by June 15.

PERSONALS.

Mr. J. L. Barclay, formerly special railway agent for the Sprague Electric Railway and Motor Company in Chicago, Ill., has severed his connection with the Sprague Company.

Mr. H. McL. Harding of Chicago, Ill., formerly general agent and recently manager of the mining department of the Sprague Electric Railway and Motor Company, has severed his connection with the Sprague Company.

G. W. Atterbery, representing the St. Louis office of the Westinghouse Company, was in Denver last week. He is looking after the sale of a plant to be erected for the lighting of the cogway road from Manitou to the summit of Pike's Peak.

Mr. Walter C. Wonham, who has been the Eastern manager for the Hill Clutch Works, of Cleveland, O., since they opened their office in this territory, has resigned his position, to take effect June 1. Mr. Wonham has had a long, hard struggle to gain a foothold for the Hill Clutch Works. The results of his efforts are too well known to the trade to require further comment by us. He has not yet fully determined upon his future course.

MISCELLANEOUS NOTES.

The Thomson Electric Welding Company have adopted the Mason reducing valves as the standard on their welding apparatus.

Chicago.—American Electric Supply Company has been incorporated to manufacture all kinds of electric apparatus; capital, $250,000; incorporators, F. E. Shaw, William Martin, W. O. Johnson.

Chicago.—The Burns Copper Welding and Manufacturing Company has been incorporated for welding and manufacture of copper, iron, steel and other metals; capital stock, $500,000; incorporators, W. J. McKeever, James Murphy, Charles Magin.

San Francisco, Cal.—Electric Street and Station Indicator Company has been incorporated; capital stock, $500,000; amount actually subscribed $420,000; directors, John L. Cahill, Lucius H. Foote, Alexander G. Hawes, Joseph D. Grant and Reuben H. Lloyd.

The City Council of Denver, Colo., has passed an ordinance creating the office of city electrician. The salary is $2,500 per year. The duties of the officer are personally to inspect the wiring of buildings throughout the city, and see that all precaution is taken against danger.

Albany, N. Y.—The Asphaltum Pipe and Subway Company has been incorporated to mine, manufacture, distribute water, and construct subways for electric conductors. Capital stock, $400,000, all of which has been subscribed. Directors, F. M. Speed, Edgar Briggs, Adrian R. Smith, George H. Hops and W. H. Warswick.

Woodhouse & Lawson United, Limited, of London, find their South African trade increasing so rapidly as to justify the opening of a branch warehouse in Johannesburg, which will be under the management of Mr. R. Lewis Cousins, M. I. E. E. By means of a detailed telegraphic code, in addition to a large stock to be maintained in Johannesburg, the company will be able to fill South African orders with a promptness not before attainable.

A State Electrical Commission Proposed.—In the Senate at Albany on Thursday, April 18, a bill was introduced by Senator Erwin to create a State Electrical Commission of four members, two Democrats and two Republicans, to be appointed by the Governor and confirmed by the Senate. The term of office would be five years, the commission to be furnished with subordinate officers, to have general charge of electrical matters and to have power to establish branch offices in cities of over 100,000 inhabitants. The bill provides that the board must cause all electric wires in such cities to be put underground, and must see that overhead wires are safe. The New York City electrical control-board is abolished. Streets cannot be opened for electrical purposes without the consent of the State board. The bill is modeled in general scope on the Railroad Commission law.

BUSINESS NOTICES.

On and after May 1 the New York office of the Ashton Valve Co. will be at 107 Liberty street.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas lighting batteries if accidentally grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company of Syracuse, N. Y., No. 105 South Warren street.

On Page IV. of this issue the Okonite Company present a facsimile of the recent letter received by their Chicago representatives, the Central Electric Company, from that well known authority on electrical matters, Foree Bain. Approval of this kind must be exceedingly gratifying to the manufacturers of Okonite wires and cables. Okonite is gathering strength every day. It is a superior insulating material, and people are fast getting to know it.

The Allis Engine is largely used in electric light and power plants. The business of the late Edward P. Allis has been reorganized under the name of the Edward P. Allis Company and the entire plant and assets have been transferred to the new corporation, of which Mr. William W. Allis is president, Edward P. Allis, Jr. first vice-president, Edwin Reynolds second vice-president and superintendent, and Charles Allis secretary and treasurer. The Allis works are one of the most important industries in Milwaukee.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

U. S. PATENTS ISSUED APRIL 15, 1890.

425,413. Balanced Pen for Autographic Telegraphs; Harry Etheridge, of Pittsburgh, Pa., Assignor to the Writing Telegraph Company, of New York. Application filed November 1, 1888. The combination with the receiving armature rod of an autographic telegraph, of a fountain pen provided with a reservoir pivoted centrally with reference to the reservoir to the armature rod and having its writing point end slightly heavier than the other, whereby the pen will rest on the paper with the same slight pressure whether the reservoir is empty or filled.

425,435. Brush Holder for Dynamo Electric Machines or Motors; Frederick A. LaRoche, of Philadelphia, Pa. Application filed Dec. 7, 1889. The combination, with the commutator and frame work of a dynamo or motor, of a rigid brush lying in a plane tangent to the commutator and a brush holder attached to the frame work, and freely and automatically movable in two intersecting plans.

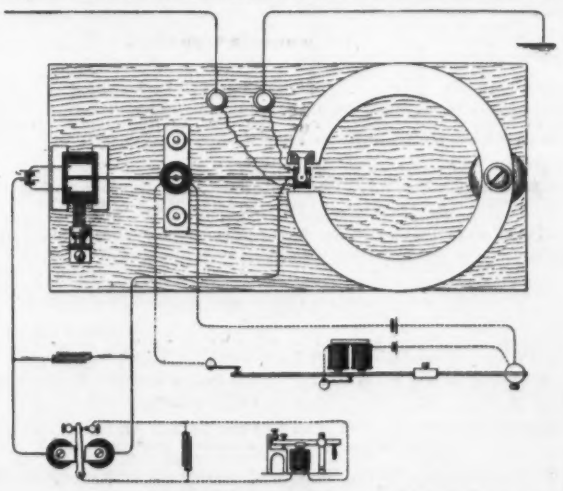
425,466. Car Telegraphs; William F. Stephens, of Joppa, Md. Application filed June 26, 1889. In a car telegraph, the combination, with a car provided with usual telegraphic instruments of a main line circuit composed of three conductors, two of which being connected to ground, each at the end opposite to the other, and the other conductor connected to the battery and the battery connected to ground, all three of the conductors being opened at one end and all three being connected with telegraphic apparatus on the car, one conductor being connected to a telegraphic key which is normally open, so that no battery current flows except when the key is closed.

425,470. Distribution of Electric Currents; Elihu Thomson, of Lynn, Mass., Assignor to the Thomson-Houston Electric Company, of Connecticut. Application filed Jan. 29, 1890. The method of maintaining or regulating the potential of any point of a system of electrical distribution, consisting in supplying energy thereto from two sources, one connected therewith over one set of mains or conductors, and the other indirectly connected therewith through another set of mains or conductors of high potential, from which the energy is transformed to low potential for application to such points.

425,488. Contact Device for Electric Railways; Francis O. Blackwell, of New York, N. Y., assignor of the Thomson-Houston Electric Company, of Connecticut. Application filed July 5, 1889. The combination, in a contact device for an electric railway, of an upright rod or arm, a horizontal extension therefrom, and a plate spring bearing upon the extension and giving a movement about a centre.

425,489. Electric Railway Contact; Francis O. Blackwell, of New York, N. Y., Assignor to the Thomson-Houston Electric Company, of Connecticut. Application filed Aug. 31, 1889. The invention consists in providing an upright structure on the roof of the car and pivoting a contact device thereon which is adapted to move laterally, and arranging it at the same time so that its lateral movement is not a movement about a centre, but a movement directly across the car. The contact rod is held up against the wire by means of a spring.

425,493. Method of Transferring Batteries; William B. Cleveland, of Cleveland, Ohio. Application filed Feb. 1, 1890. A step in a method of transferring secondary vehicle batteries, consisting in simultaneously removing the exhausted battery from the vehicle and inserting the freshly charged battery in position on the vehicle.



No. 425,597.—CABLE TELEGRAM RECEIVER.

425,507. Electric Snap Switch; Cornelius J. Hamilton, of Philadelphia, Pa., Assignor to the Novelty Electric Company, of same place. Application filed Jan. 20, 1890. An electric switch, in combination with a base of insulated material, a vertical shank journaled in the base, a series of independent alternately insulated and conducting plates, each having an inclined under surface secured to the base, inclined substantially in the same direction to allow of a continuous rotation of the connecting plate in one direction, alternate plates being connected with electric circuits, a contact plate fixedly secured to the vertical shank and retained against the under side of the plates and in connection therewith by a spring.

425,511. Telegraph Transmitter; Francis W. Jones, of New York, N. Y. Application filed June 11, 1889. In a telegraph transmitter a lever controlled by an electric magnet, and a yielding contact supported independently of the lever and connected to main line, a fixed contact of one polarity and which the yielding contact is arranged to connect, and a retractor connected to ground or the other polarity applied to the contact lever and arranged to act on same to engage it with the yielding contact and remove it from connection with fixed contacts.

425,513. Insulator; William P. Kookogey, of Brooklyn, New York. Assignor to the Kookogey Electric Company, of same place. Application filed Jan. 9, 1890. An electric wire insulator having a water deflecting shed or hood as a part thereof, with its edge turned upward at the points which lie in the vertical plane of the line wire.

425,568. Thermo Electric Battery; John Edelkamp, of New York, N. Y. Application filed Jan. 23, 1890. It consists in combining the alloy with a protective outer casing of baked clay sufficiently hard to resist the action of heat and ordinary handling, and which is enlarged at the end to be exposed to the heat of the furnace.

425,570. High and Low Water Alarm for Boilers; Albert C. Griggs, of Wilmington, Del. Application filed April 6, 1889. In a high and low water alarm for boilers, an electric circuit in which is an electro magnet controlling a steam whistle, and an arm secured at one end to a float in the water chamber, the arm arranged to come in contact with stops at either high or low water mark, and close the circuit.

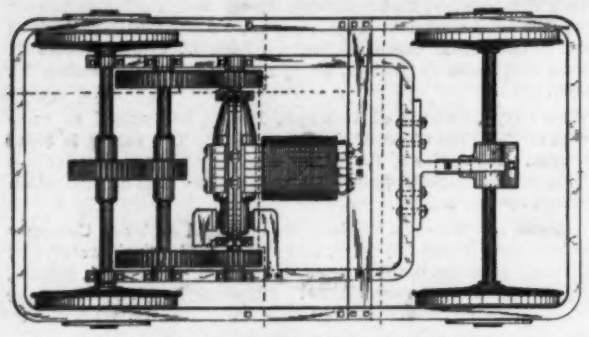
425,576. Signal Box; Morris Martin, of Malden, Mass., Assignor to the Municipal Signal Company, of Portsmouth, N. H. Application filed Feb. 25, 1887. In a signal box, a multiple signal transmitter having a manual signal selecting device adapted to be moved to set the transmitter for different signals, and a switch co-operating with the said transmitter for an additional signal and an actuating device or pull for the transmitter, combined with two additional actuating devices for the transmitter and keys therefor, the said switch being moved by one of said keys.

425,579. Electric Meter; Victor Popp, of Paris, France, Assignor to the Popp Compressed Air and Electric Power Co. (limited). Application filed July 6, 1888. Patented in France, Nov. 27, 1887; in England, Nov. 18, 1887; in Germany, Dec. 24, 1887, and March 28, 1888; in Belgium, May 7, 1888, and in Italy, June 30, 1888. The combination with electric lights in multiple arc, of a switch and magnet in the main circuit, a pneumatic clock, a controlling valve therefor, a connection between the valve and the

armature of the electro magnet, and a retractile spring, whereby the time during which a group of electric lamps are in use may be measured by a single apparatus.

425,588. Cut-out; Elihu Thomson and Edwin Wilbur Rice, Jr., of Lynn, Mass. Application filed May 19, 1887. In an incandescent lamp cut-out and support, the combination of a base plate carrying an automatic cut-out switch for completing a shunt around the lamp, a socket for the lamp sustained by a rod pendant from the base plate, and a pan or receptacle secured to the pendent rod between the base plate and socket to catch the fused metal.

425,594. Electric Call; Jacob B. Currier, of Lowell, Mass., Assignor to the Currier Telephone Bell Company, of Mass. Application filed October 17, 1881. The combination of an electric circuit, a vibrating circuit breaking mechanism therein arranged to make and break the circuit regularly and automatically at a



No. 425,627.—ELECTRIC CAR MOTOR.

predetermined rate of vibration, and an alarm mechanism in the circuit, consisting of magnet, bell and a vibrating striker arranged to automatically vibrate synchronously with the circuit breaker, whereby the variation in the rate of vibration of the striker produced by its blow upon the bell will be overcome by the magnet upon the rebound of the striker toward it.

425,597. Receiving Apparatus for Cable Telegraphy; Patrick B. Delaney, of New York, N. Y. Application filed July 15, 1889. The invention consists in the use of an oscillating coil substantially such as is used in the Thomson recorder, a vibrated contact finger carried thereby, contact on opposite sides of its neutral line, across and upon which it plays or with which it makes contact, an ordinary telegraphic receiving apparatus connected with the contacts and vibrated finger, for instance, a split battery, a polarized relay and sounder.

425,627; Electric Car Motor: Edgar Peckham, of New York, N. Y. Application filed Dec. 2, 1889. The core of the magnet consists of two sets of longitudinal bars one set of greater length than the other, and a series of cross plates of different lengths uniting the heel ends of the bars and a non-magnetic plate connecting the pole ends of the bars.

425,630. Electric Call; David Hill Rice, of Lowell, Mass., Assignor to the Currier Telephone Bell Company, of Massachusetts. Application filed Feb. 13, 1882. In combination with the base board, two or more attached circuit breakers and an attached circuit, and connecting short circuits leading from the circuit breakers to a series of keys, the whole being organized into a completed calling machine and adapted to sound different alarms upon an electrical circuit connected therewith.

425,631. Telephone Bell and Connection; David Hall Rice, of Lowell, Mass., Assignor to the Currier Telephone Bell Company, of Mass. Application filed Nov. 16, 1881. The combination of two or more electric circuits, a switch mechanism, a caller connected to the switch mechanism by the two independent or branch wires, and adapted to send a succession of electric impulses over the circuits, a battery, and electro magnetic annunciators connected to the switch mechanism by independent wires.

425,640. Guard for Electric Railway Trolleys: Elihu Thomson, of Lynn, Mass., Assignor to the Thomas Houston Electric Company, of Connecticut. Application filed Feb. 10, 1890. The invention consists in attaching to the outer end of the trolley pole a frame or guard around the trolley wheel or contact device, by which in case of derailment of the contact device it will be impossible for the outer end of the trolley pole to be thrown up beyond the conductor so as to interrupt the circuit and interfere with the cross wires.

425,694. Trolley; Wallace Porter and Henry George, of Wilkesbarre, Pa. Application filed March 9, 1890. In a trolley, the combination with the hub, the ends of which are oppositely threaded and a rigid boss mounted upon the hub between its ends, of opposite annular flanges threaded upon the ends of the hub, and a removable wearing ring snugly fitting the boss and bound upon by the opposite flanges.

425,720. Franklin C. Wheeler, of St, Joseph, Mo., Assignor of one-half to Henry George, of same place. Application filed Oct. 9, 1889. My invention consists in the combination, with a car, of

No. 425,640.—GUARD FOR TROLLEYS.

a tube containing a weight and provided with a detent for holding the weight in an elevated position, and a chain or cord connected with the weight and with the trolley, the whole being arranged so that when the trolley jumps from the conductor it will release the weight, which will draw down the trolley so that it will not come in connection with the overhead work.

425,726. Cut-Out; Charles Batchelor, of New York, N. Y. Application filed May 1, 1885. The combination, with an electric lamp, of an electro-magnet in a shunt around the same, an armature lever controlled thereby, a spring catch for locking the lever in its forward position, a contact carried by the armature lever, a contact moved by the spring catch and a shunt around the lamp and magnet, including the armature lever and the contacts.

425,741. Incandescent Lamp Socket; James J. Bradley, of Harrison, N. J., Assignor to the Edison Lamp Company, of same place. Application filed Oct. 18, 1889. The invention consists in providing the interior of the screw-threaded sleeve of the socket with a slightly depressed tongue, which produces a sufficient friction or pressure on the lamp base to prevent the lamp from working loose.

425,757. Electric Heating Apparatus for Electric Railway Systems; Mark W. Dewey, of Syracuse, N. Y., Assignor to the Dewey Corporation of same place. Application filed Jan. 27, 1890. The invention consists in the combination, with a series electric railway, or a railway employing a constant or nearly constant current in the supply circuit, of traveling vehicles, electric motors on the vehicles electrically connected to the supply circuit, to propel the vehicles, electric heaters to heat the vehicles and connected in the supply circuit in series, and means to regulate the current flowing through the heaters.

425,760. Measurement of Electricity in Distribution Systems; Thomas A. Edison, Menlo Park, N. J., Assignor to the Edison Electric Light Company, of New York, N. Y. Application filed June 22, 1881. Patented in England Oct. 19, 1881, and in France Dec. 17, 1881. The combination, in a system of electrical distribution employing a complete metallic circuit, of a meter located in circuit between one side of the system and the earth at the point of generation.

425,761. Incandescent Lamp; Thomas A. Edison, of Menlo Park, N. J. Application filed Nov. 22, 1883. The improvement in the process of manufacturing incandescent electric lamps, consisting in statically charging the lamp from a frictional or other source of static electricity while the leading-in wires of the lamp are connected to the earth or its equivalent.

425,762. Cut-Out for Incandescent Electric Lamps; Thomas A. Edison, of Llewellyn Park, N. J. Application filed March 8, 1888. In an incandescent electric lamp, the combination of the globe, the hollow base secured thereto, a stationary contact piece attached to said base and connected with one terminal of the lamp, a movable contact piece within said base connected with the other terminal, and a fusible wire attached to the movable contact piece and extending from the interior of the globe and holding said movable contact piece normally out of contact with the stationary one, whereby the lamp filament is short-circuited by the fusion of said wire.

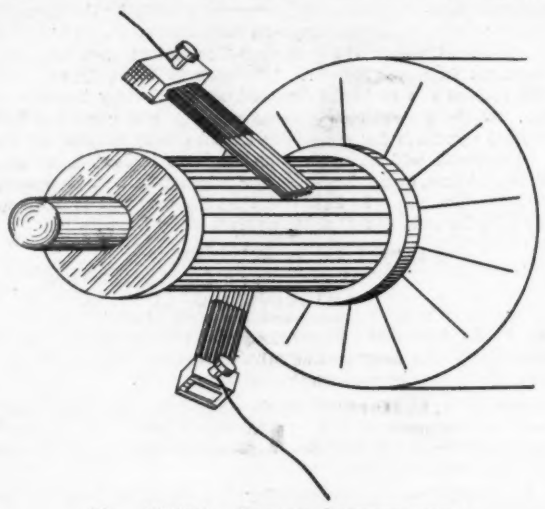
425,763. Commutator for Dynamo Electric Machines; Thomas A. Edison, of Menlo Park, N. J., Assignor to the Edison Electric Light Company, of New York, N. Y. Application filed Nov. 15, 1881. In dynamo electric machinery, the combination of a commutator composed of conducting bars separated by insulation and brushes, or current collectors bearing thereon, the same having amalgamated contact surfaces.

425,767. Electric Railway; Thos. Aaron Evans, of San Francisco, Cal. Application filed July 25, 1889. The combination with a stationary conductor of the trolley or traveler having wheels mounted in insulated boxes and binding posts having electrical connection with the wheels, and the conducting wire extending from the binding post to a binding post on the shank in the car.

425,777. Electric Door Opener; William Lodowick Godfrey, of Brooklyn, N. Y., Assignor of one-half to H. F. Hollsberg, of same place. Application filed Sept. 12, 1889. In a door-opener, the combination, with a tumbler, a keeper, a locking device for the keeper, and means for releasing the same, of a cam interposed between the tumbler and keeper and adapted to be moved positively in both directions by the tumbler.

425,801. Electric Lighting System; Frederick Johnson, of Brooklyn, Assignor to the Edison Machine Works, of Schenectady, N. Y. Application filed Nov. 2, 1889. The combination, with the intersecting and connected conductors of an electric lighting system of fusible safety catches interpolated in the conductors between the points of intersection and connection, and an indicating device in a loop around the fuse.

425,818. Secondary Battery; James McLaughlin, of Philadelphia, Pa. Application filed Jan. 3, 1890. To this end the invention consists in a tray provided with recesses or troughs con-



No. 425,763.—EDISON COMMUTATOR.

taining a suitable conducting material, liquid or solid, such as mercury or copper in combination with a series of cells whose conducting strips extend down along the sides and below the bottoms of the cells so as to contact with or be immersed into the conducting material.

425,819. Secondary Battery Electrode; James F. McLaughlin, of Philadelphia, Pa. Application filed Jan. 8, 1890. An electrode for secondary batteries, consisting of a supporting head of conducting material and a series of rods composed of active and binding material, the rods being held at one end in the head.

425,853 Electric Circuit for Telephone Purposes; Arthur W. Berne, of New Orleans, La., Assignor to Brownlee W. Taylor and Samuel B. McConnico, of same place. Application filed Sept. 24, 1889. A system for electric intercommunication, consisting of a series of main lines which are connected with a switchboard at each end, an instrument for each end of each line, a second switchboard having two plates for each instrument, two wires from each telephone connected with the plates on the second switchboard, and flexible pieces on each station for establishing communication with the plates of the second switchboard of one station with the plates of the second switchboard of the other station.

425,862. Multiple Telephony; John J. Carty, of New York N. Y., Assignor to the American Bell Telephone Company, of Boston, Mass. Application filed Nov. 13. 1889. A through metallic telephone circuit extending between two terminal stations and one or more immediate metallic electrical circuits superimposed thereon and extending between any given two stations on the said through circuit, one of the conductors of each superimposed circuit being formed of the two sides of that section with the through metallic circuit, which extends between the two stations of the superimposed circuit, serving jointly as a substantially single conductor, and having for its other side or conductor a separate and independent wire, also extended between the said stations.

425,863. Telephone System; John J. Carty, of New York, N. Y., Assignor to the American Bell Telephone Company, of Boston, Mass. Application filed Nov. 13, 1889. In a system for telephonic communication, the combination, with a telephone transmitter at one station and an energizing battery therefor at another station, of a double wire circuit extending between the two stations, and including said transmitter in a metallic circuit, both of the wires being in connection with the same pole of the battery, thereby constituting jointly a single conductor of relatively high conductivity for the battery currents.

425,866. Electric Railway Car; Mark W. Dewey, of Syracuse, N. Y., Assignor to the Dewey Corporation, of same place. Application filed April 8, 1889. The invention consists in supplying an electric motor on a car with electricity to propel the same from stationary electric supply or working conductors arranged along the track or roadway, and also supplying a signaling circuit on the car with electricity from the same source for signaling purposes, and further, in so connecting a signal circuit with the conductor on the car that the signal devices therein may be operated independent of the condition of the motor circuit.

425,883. Electrically Propelled Car; Rudolph M. Hunter, of Philadelphia, Pa. Application filed Oct. 31, 1889. The invention provides the car with an automatic regulator independent of the regulator of the operator, which operates, upon the passage of any abnormal speed of the motor and vehicle produced thereby, to shut down the current and prevent the speed increasing beyond a given limit.

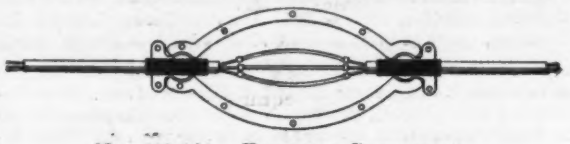
425,902. Secondary Battery; Gustave Philippart, of Paris France. Application filed Jan. 6, 1890. Patented in France Jan. 26, 1889; in Belgium Jan. 28, 1889; in England Jan. 30, 1889, and in Germany Feb. 1, 1889. In the art of constructing secondary battery elements, the improvement consisting in applying to a conducting support a layer of fabric impregnated with active material, covering the same with a perforated sheet of neutral material, and uniting the three thicknesses by compression.

425,903. Appliance for Preventing Incrustation; William H. Porter, of Washington, D. C., Assignor of two-thirds to Charles W. Schneider and Clarence Baker, of same place. Application filed July 20, 1889. The combination, with a steam boiler, so that its ends or poles will be in contact with the lower part of the boiler or its flues under water.

425,911. Richard V. R. Sill, of Detroit, Mich., assignor of one-half to Strathearn Hendrie, of same place. Application filed March 13, 1889. In an electric railway, a car having its wheels insulated from their axles, a converter on the car having its primary connected with two diagonal wheels of the car and its secondary with the poles of an electric motor.

425,912. Electric Railway; Richard V. R. Sill, of Detroit, Mich., Assignor of one-half to Strathearn Hendrie, of same place. Application filed March 13, 1889. In an electric railway, a track divided into sections, a single electrical conductor extending along the track, and electrically operated switch connected with the conductor between each section of track, and having each terminal connected with one rail, and a motor having its poles connected with the rails.

425,913. Wire Conduit; Andrew J. Smith, of Soldiers' Home, Kansas. Application filed Sept. 17, 1889. An electric wire conduit made of hollow bricks and formed into a street curbing, certain of the bricks having a vertically sliding removable shutter dove-



No. 425,961.—ELECTRIC CONDUCTOR.

tailed into the bricks, whereby access may be had to the conduit.

425,917. Electric Conductor. Eugenio Tortora, of Florence, Italy. Application filed April 14, 1889. Patented in Italy Dec. 3, 1886; in France, March 23, 1887; in Belgium, March 23, 1887; in England, March 31, 1887; and in Austria-Hungary, Sept. 26, 1888. The invention consists in tubes for inclosing electrical conductors comprising a series of glass boxes of wedge-shaped or inclined side bases hermetically sealed or connected together, the narrow end of one box being inserted in the widened end of the adjacent box.

425,923. Method of Operating Synchronous Alternating Current Motors; Carl Zipernowsky, of Buda-Pesth; Maximilian Deri, of Vienna, and Otta Titus Blathy, of Buda-Pesth, Austria-Hungary. Application filed Aug. 9, 1889. The mode of operating a synchronous alternating current motor by starting the motor without short-circuiting the magnet windings and by short-circuiting them at each reversal of the current when synchronism is reached, and introducing a suitable resistance in the supplying circuit.

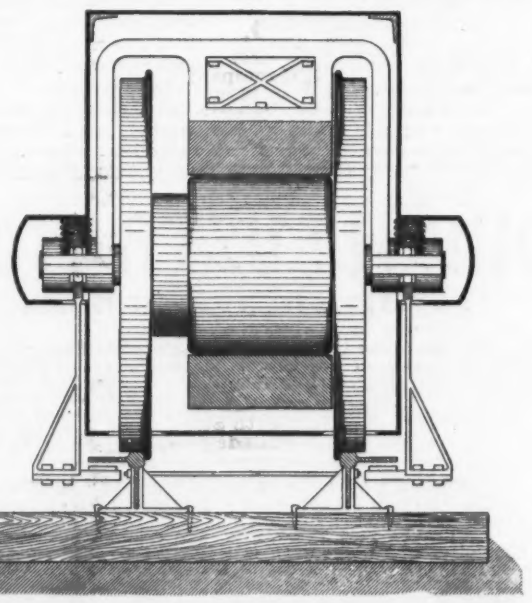
425,950. Electric Railway; Walter H. Knight, of New York, N. Y. Application filed Sept. 21, 1887. In an electric railway, the combination of a supply conductor inclosed in a conduit, a contact device extending into the conduit and connected with a vehicle on the roadway, but movable laterally relatively thereto, and an electrical conductor leading from the contact device to the motor on the vehicle having an electrical spring clip connection.

425,957. Secondary Battery; Gustave Philippart, of Paris, France. Application filed Jan. 6, 1890. In combination with electrodes having cellular plates filled with active material and perforated retaining sheets, an insulating grating separating the electrodes and provided with swelled portions or projections opposite the cells.

425,959. Galvanic Battery; Louis Marie Joseph Charles Clement Renard, of Meudon, near Paris, France. Application filed March 5, 1889. Patented in Belgium June 9, 1888; in England June 13, 1888; in France July 20, 1888, and in Italy Oct. 22, 1888. A galvanic cell consisting of a cup containing chlorochromic acid and silver electrodes platinized on both surfaces by lamination.

425,961. Electric Conductor; Philip Seubel, of New York, assignor to the Edison Machine Works, of Schenectady, N. Y. Application filed Jan 16, 1889. The invention consists in providing for an electrical conductor a metal covering divided throughout its length into a number of sections, with a coupling box at the points of division insulated from the metal covering.

425,963. Electric Switch; Ernest P. Warner, of Chicago, Ill. Application filed Feb. 2, 1889. The combination, with the metal side pieces mounted upon rubber blocks placed between



No. 425,966.—ELECTRIC RAILWAY.

them, of the pivoted rubber block provided with the concentric surface of the trunnions or pivots of the pivoted block resting in bearings provided in the metal side pieces, contact springs or levers in proximity to the concentric surface, and upper and lower contact points between which the contact springs are adapted to be moved.

425,964. Electric Railway System; David G. Weems, of Baltimore, Md., Assignor to the Electro-Automatic Transit Company, of same place. Application filed July 27, 1889. In electric railways, the combination of a suitable frame work, the brackets placed transversely thereon and grooved at each end to receive the vertical webs of the main rails, a carrier or locomotive having a divided axle, bolts securing the parts of the axle together, and insulating material between the meeting ends of the axle and surrounding the bolts.

425,966. Electric Railway; David G. Weems, of Baltimore, Md., Assignor to the Electro-Automatic Transit Company, of same place. Application filed August 1, 1889. In electric railways, the combination with a rail having a laterally projecting flange, whose under surface forms a supplemental track, a frame suspended from a car or train and having a lateral arm provided with a grooved seat and a bearing block or shoe secured in the seat and adapted to bear against the under surface of the flange of the rail.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give date and number, and address The W. J. Johnston Co. Ltd., Times Building, N. Y.